Monday, 6th December

09:10 h

Where did the fifty-year search for laser crystals and ceramics take us? (invited)

Alexander A. Kaminskii

Russian Academy of Sciences, Institute of Crystallography, Moscow, Russia

During half a century history of the laser era the search for laser crystals and ceramics has brought many important results. They have largely determined the development and formation of laser physics. Applications of laser crystals and ceramics are well known. Some of them (mainly with Ln3+ lasants) in the report would be given special attention. Unfortunately, the further success of the search and application of laser crystal materials prevented a number of issues that have not been fully resolved over the years. Some of these problems will be considered in the report taking into account modern trends of laser physics and nonlinear optics.

09:35 h

High pulse energy and high average power laser by using a composite ceramic (invited)

Junji Kawanaka[1], Hiroaki Furuse[2], Takuya Nakanishi[1], Yasuki Takeuchi[1], Akira Yoshida[1]

[1]Osaka University, Institute of Laser Engineering, Japan, [2]Osaka University, Institute for Laser Technology, Japan

Diode-pumped solid-state laser has been developed by using a cryogenic composite ceramics. A novel laser amplifier arrangement of total-reflection active-mirror was proposed for high-pulse-energy and high-average-power simultaneously. The regenerative amplifier was demonstrated and a joule-class multi-pass amplifier is under construction.

10:00 h

Thin-disk laser properties and photoconductivity of single crystalline and ceramic Yb:YAG

Susanne T. Fredrich-Thornton, Ulrike Wolters, Günter Huber, Klaus Petermann

University of Hamburg, Institute of Laser-Physics, Germany

A decrease in laser efficiency with inversion density is found for Yb:YAG thin-disk lasers. Ceramic samples seem less affected compared to single crystals. The differences in laser performance of the two material classes are discussed together with photoconductivity results.

10:20 h

High efficiency lasing using 10% Yb^{3+} doped Lu_2O_3 ceramics

Jas Sanghera, Woohong Kim, Guillermo Villalobos, Jesse Frantz, Brandon Shaw, Fred Kung, Ishwar Aggarwal

Naval Research Laboratory, Washington, DC, USA

We demonstrate lasing at 1080 nm in 10% Yb^{3+} doped Lu_2O_3 transparent ceramics with an output power greater than 8 Watts and a slope efficiency of approximately 60%. We will describe the synthesis and properties of the heavily doped Lu_2O_3 ceramics.

11:10 h

Characterization of absorption losses in YAG laser ceramics (invited)

Romain Gaume, Bob Byer

Stanford University, Ginzton Laboratory, Standford, CA, USA

We will report on comparative thermalized absorption measurements obtained in various YAG transparent ceramics and single-crystals. Correlations with lattice defects and impurities content will be discussed.

11:35 h

Effect of grain boundaries on the thermo-optical properties of Nd^{3+}:$Y_3Al_5O_{12}$ highly transparent ceramics as a function of temperature

Antonio Benayas[1], Daniel Jaque[1], Jose García-Solé[1], Tomaz Catunda[2], Alexander A. Kaminskii[3], Carlos Jacinto[4]

[1]Universidad Autónoma de Madrid, Departamento de Física de los Materiales, Madrid, Spain, [2]Universidade de São Paulo, Instituto de Física de São Carlos, São Carlos, Brazil, [3]Russian Academy of Sciences, Institute of Crystallography, Moscow, Russia

The effect of grain boundaries on the thermo-optical properties as a function of low temperature (90-300K) was investigated in Nd:YAG ceramics with grain-size of 2, 10, and 18 μm and compared with the single crystal (all with 1*at*.% of Nd^{3+}).

11:55 h

Time-resolved luminescence characteristics of Ce and Nd doped YAG ceramics obtained by high pressure technique

Larisa Grigorjeva[1], D. Millers[1], K. Smits[1], D. Jankovica[1], W. Lojkowski[2], Anna Swiderska Sroda[2], Wieslaw Strêk[3], P.Gluchowski[3]

[1]University of Latvia, Institute of Solid State Physics, Riga ,Latvia, [2]Polish Academy of Sciences, Institute of High Pressure Physics, Warshaw, Poland, [3] Polish Academy of Sciences, Institute of Low Temperature and Structure Research, Wroclaw, Poland

Transparent YAG ceramic were prepared by the synthesis under high pressure (up 8 GPa) at relative low temperature (High Pressure Low Temperature - HPLT). The luminescence properties were studied before and after ceramics annealing at different temperatures. A special attention is given to defect nature and defect annealing processes since the defects induced under high pressure greatly reduce the luminescence decay time and ceramic transparency.

12:15 h

Migration-accelerated luminescence quenching in spherical nanoparticles

Tasoltan Basiev, Nikolay Glushkov, Irina Basieva

Russian Academy of Sciences, Prokhorov General Physics Institute, Moscow, Russia

We show that supermigration quenching kinetics in spherical nanoparticles can be adequately described by two stages exponential decay with the maximal rate somewhat lesser than in bulk case, and second, Foerster-like stage proportional to the exponent of square root of time.

Monday, 6th December

13:35 h

Ceramic materials for visible solid-state lasers (invited)

Ulrich Weichmann, Uwe Mackens, H. Moench, J. Opitz

Philips Technologie GmbH Forschungslaboratorien, Aachen, Germany

For consumer applications of lasers, ceramic laser materials play an important role with respect to the integration aspects of the laser setup. In this contribution we will present results from our work on integrated green efficient lasers for projection systems.

14:00 h

Nd^{3+}-doped $Ba(Zr^{4+},Mg^{2+},Ta^{5+})O_3$ ceramics as laser materials (invited)

Satoshi Kuretake[1], N. Tanaka[1], Y. Kintaka[1], K. Kageyama[1], H. Kurokawa[2], M. Tokurakawa[2], A. Shirakawa[2], Ken-ichi Ueda[2], Alexander A. Kaminskii[3]

[1]Murata Manufacturing Co., Ltd.Japan, [2]University of Electro-Communications, Institute for Laser Science, Shimane, Japan, [3]Russian Academy of Sciences, Institute of Crystallography, Moscow, Russia

We report transparent Nd^{3+}-doped $Ba(Zr,Mg,Ta)O_3$ (Nd:BZMT) ceramic as laser materials. The results of the structural analyses and the fluorescence properties in Nd:BZMT fabricated by adjusting the BZMT composition in order to substitute Nd dopants at different crystal sites will be reported.

14:25 h

Transparent Nd:YAG ceramics fabricated by solid-state reaction method

Vladislav A. Shitov, V.V. Osipov, V.I. Solomonov

Russian Academy of Sciences (Ural Division), Institute of Electrophysics, Yekaterinburg, Russia

Transparent Nd:YAG ceramics were fabricated by solid-state reaction method using high-purity Nd:Y_2O_3 and Al_2O_3 powders fabricated by laser evaporation method. Powders were mixed without additives, uniaxial pressed and sintered under vacuum. The optical transmittance of synthesized ceramic sample (3 mm thick) was 81.35% at 1064 nm.

15:15 h

Segregation phenomenon of rare earth dopants in ceramics (invited)

George Boulon[1,2], W. Zhao[1,3], S. Anghel[1,4], C. Mancini[1], D. Amans[1], T. Epicier[5], V. Chani[2], A. Yoshikawa[2]

[1]University of Lyon, Physical Chemistry of Luminescent Materials Lab, Lyon, France, [2]IMRAM, Tohoku University, Sendai, Japan, [3]University of Science and Technology of China, Anhui, China, [4]Institute of Applied Physics, Chisinau, Republic of Moldova, [5]University of Lyon, Matériaux, Ingénierie et Sciences (MATEIS), Villeurbanne, France

We analyse segregation phenomenon of Ce^{3+} (first position) and Yb^{3+} (last position) rare earth dopants in grain and grain boundaries of oxide optical ceramics from imaging confocal microscopy and transmission electronic microscopy. Interpretation is related with growth from liquid phase.

15:40 h

Up-conversion phenomena in RE^{3+}-doped transparent nanoceramics (invited)

Wieslaw Strêk[1], P. Gluchowski[1], R. Wiglusz[1], D. Hreniak[1], O. Ignatenko[2]

[1]Polish Academy of Sciences, Institute of Low Temperature and Structure Research, Wroclaw, Poland, [2]National Academy of Sciences, Scientific-Practical Materials Research Centre, Minsk, Belarus

The double Er^{3+} and Yb^{3+} doped YAG, KYF_4 and $MgAl_2O_4$ transparent nanocrystalline ceramics were sintered under high pressure at relatively low temperature. The comparative studies of up-con-version fluorescence of Er^{3+} after direct excitation of Yb^{3+} in different crystalline hosts was per-formed. The effect of applied sintering pressure on up-conversion intensities in different nanocera-mics was observed. The dependence of up-con-version intensity on incident light excitation power was studied. It was found the overall fluorescence characteristics of Er^{3+}.

- continuation of column 1-

A relative distribution of fluorescence bands (green/red ratio) was depen-dent on incident light intensity. This dependence could be correlated with the averaged tempera-ture of nanoceramic. It was suggested that such up-conversion nanoceramics could be applied in high temperature thermometry.

16:05 h

Thermo-optical measurements of ytterbium doped sesquioxides ceramics

Vanessa Cardinali[1], Emilie Marmois[1], Bruno Le Garrec[1], Gilbert Bourdet[2]

[1]CEA-CESTA (Centre d'Etudes Scientifiques et Techniques d'Aquitaine), Barp, France, [2]LULI, École Polytechnique, Palaiseau, France

Measurements of the key thermo-optical properties (thermal conductivity, thermal expansion coefficient and thermo-optical coefficient dn/dT) of Yb3+ in sesquioxides ceramics Y2O3, Sc2O3, Lu2O3 are done at room and cryogenic temperatures. We show that laser performances are improved at low temperatures.

16:25 h

Transparent ceramics for photonic applications

H. Yagi, T. Yanagitani

Konoshima Chemical Co. Ltd., Takuma Works, Kagawa, Japan

Since 1980's, we have been developing various transparent ceramics for photonic applications, such as YAG, LuAG, TGG, disordered garnet, sesquioxide etc. These materials are suitable for photonic applications, not only laser gain medium, but also for scintillator , phosper, optical window and so on.This presentation will briefly review the state-of-the-art optical and physical properties of these ceramics.

Tuesday, 7th December

09:00 h

Optical properties of transparent GdYAG:Ce ceramics for white LED (invited)

Setsuhisa Tanabe, Shotaro Nishiura

Kyoto University, Graduate School of Human and Environmental Studies, Japan

Transparent Ce^{3+}-doped GdYAG ceramics were fabricated by the vacuum sintering of powders prepared by co-precipitation method. By exciting with a blue LED, the ceramics on top showed excellent luminous efficacy and good color rendering as a white LED. In the PL spectra, the wavelength shift of the Ce^{3+}:5d-4f transition was observed by Gd substitution of Y-site, as well as in the PLE spectra.

09:25 h

Microstructuration techniques for the development of miniturized Nd:YAG ceramic lasers (invited)

D. Jaque[1], A. Benayas[1], W. F. Silva[2], C. Jacinto[2], J. Vazquez de Aldana[3], G.A. Torchia[4], A.A. Kaminskii[5]

[1]Universidad Autónoma de Madrid, Dep. de Física de Materiales, Spain, [2]Universidade Federal de Alagoas, Instituto de Física, Brazil, [3]Heriot-Watt University, School of Engineering and Physical Sciences, UK, [4]Universidad de Salamanca, Dep. de Física Aplicada, Spain, [5]Shandong University, School of Physics, Jinan, P. R. China, [6]CONICET-CIC, Centro de Investigaciones Ópticas, La Plata, Argentina

The last developments achieved in the micro-structuration of Nd:YAG ceramic lasers for their incorporation in active photonic devices will be discussed. We will pay special attention to the fundamentals of the different techniques used up to now.

09:50 h

Preparation of YAG:Ce-dispersed transparent CaF_2 ceramics and application to white LEDs

Hitoshi Ishizawa, Yoshinobu Ezura

Nikon Corporation, Materials & Advanced Research Laboratory, Kanagawa-ken, Japan

We have developed transparent CaF_2 ceramics. In this study, YAG:Ce-dispersed CaF_2 ceramic phosphors were prepared for white LEDs. The characteristics and optical properties of the ceramics will be reported.

10:10 h

New development in ytterbium doped CaF_2 transparent ceramics for high power lasers

Andréas Lyberis[1], Patrick Gredin[1], Gilles Patriarche[2], Daniel Vivien[1], Michel Mortier[1]

[1]Chimie ParisTech, Laboratoire de Chimie de la Matière Condense de Paris, France, [2]Centre National de la Recherche Scientifique, Laboratoire de Photonique et de Nanostructure, Marcoussis, France

We are working on ytterbium doped calcium fluoride transparent ceramics elaborated from nanopowders synthesized through a soft chemistry route. An optical loss study shows both the existence of inhomogeneities at grain boundaries such as dopant segregation, and of ytterbium clusters.

11:00 h

Transparent ceramics for optical and fluorescence applications (invited)

Yvonne Menke

SCHOTT AG, Corporate Research and Technology Development, Mainz

In this paper new developments in the fabrication of high refractive index materials with cubic crystal structure as possible matrix material for rare-earth activated compounds are described. Related applications in both optical and fluorescence application fields are illustrated.

11:25 h

Anisotropic ceramics as a next generation laser (invited)

Takunori Taira

Institute for Molecular Science (IMS), Laser Research Center for Molecular Science, Okazaki, Japan

Transparent polycrystalline ceramics for laser applications have been demonstrated to offer tremendous processing and design advantages relative to Czochralski-grown single crystals. After the review of conventional ceramic lasers, we'd like to discuss the next generation of ceramic lasers based on the anisotropic ceramics.

11:50 h

Spectroscopic and oscillation properties of Nd^{3+} ions in newly developed SrF_2 laser ceramics

Maxim E. Doroshenko, T. T. Basiev, V.A. Konyushkin, D.V. Konyushkin, A.N. Nakladov, V.V. Osiko

Russian Academy of Sciences, Prokhorov General Physics Institute, Moscow, Russia

SrF_2 laser ceramics were developed using hot pressing technique. Oscillation spectrum of Nd^{3+} ions in SrF_2 ceramics was found to change with laser diode pumping wavelength. Laser oscillations of Nd^{3+} ions in SrF_2 ceramics under laser diode pumping for different pumping geometries were obtained with slope efficiency up to 19%.

12:10 h

The microstructure of erbium-ytterbium co-doped oxyfluoride glass-ceramic optical fibers

Elżbieta Augustyn, Michał Żelechower

Silesian University of Technology, Department of Materials Science, Poland

Er^{3+} and Yb^{3+} co-doped oxyfluoride glass-ceramic fibers have been obtained by controlled crystallization of the glass fibers. Glasses of the following composition $48SiO_2$-$11Al_2O_3$-$7Na_2CO_3$-10CaO-10PbO-$10PbF_2$-$3YbF_3$-$1ErF_3$ were fabricated from high purity commercial chemicals. The fabricated glass preforms were drawn into glass fibers. The transparent oxyfluoride glass-ceramic fibers were obtained by heat treatment of glass fibers. High-resolution electron microscopy (HRTEM) and X-ray diffraction (XRD) allowed to demonstrate their mixed amorphous-crystalline microstructure and nano-crystals of size even below 10 nm have been identified as $Er_3FO_10Si_3$, $Pb_5Al_3F_{19}$, and $Er_4F_2O_{11}Si_3$.

Tuesday, 7th December

13:30 h **POSTER SESSION**

Transparent LuAG:Nd ceramics as alternative laser gain media

Tobias Dierkes, Benjamin Herden, Thomas Jüstel

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

The continuous rise to prominence of optically transparent ceramics is mainly due to their many advantages in comparison to single crystals. In this study the garnet system $Lu_3Al_5O_{12}$ (LuAG) was examined and it was tried to obtain transparent ceramics with minimized scattering at grain boundaries and cavities thus with a high theoretical density (>99.9%).

On the host lattice $LiYF_4$ doped by trivalent praseodymium as a transparent ceramic laser material

Benjamin Herden, Thomas Jüstel

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

The study deals with the synthesis of $LiYF_4$-based laser ceramics, doped by Praseodymium, as converter materials for blue lasers. Different preparation methods were reviewed to obtain ceramics with densities close to the theoretical value. Achieved translucent ceramics were characterised by optical spectroscopy.

On the correlation between the composition of garnet type materials and their photoluminescence properties

Arturas Katelnikovas[1,2], Dominik Uhlich[1], Helga Bettentrup[1], Julian Plewa[1], Aivaras Kareiva[2], Thomas Jüstel[1]

[1]Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany, [2]Vilnius University, Department of General and Inorganic Chemistry, Vilnius, Lithuania

In the present study, the luminescent properties of rare earth ion doped garnet type host lattices are discussed as a function of their composition and thus the chemical details of the crystal structure. The results will be summarized and correlated to the crystal field strength and centroid shift governing the position of the crystal-field components of the excited state configuration of the activators Ce^{3+}, Pr^{3+}, and Nd^{3+}.

Electrophoretic deposition of cylindrical bodies from nano-alumina dispersions

Joanna Micior, Michael Bredol

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

Electrophoretic deposition (EPD) is mostly used for the fabrication of ceramic green layers. Here we present a method to fabricate dense cylindrical green bodies on stainless-steel electrodes using a removable plastic form. After defining the optimal electrophoretic conditions (methods of particle charging, stabilization of colloids in aqueous media, pulsed DC to obtain bubble-free deposits) nano-alumina dispersions were deposited. The results confirm that uniform and dense green bodies can be prepared from commercial Al_2O_3 powder.

Electrophoretic deposition of nano-yttria and nano-YAG

Joanna Micior, Michael Bredol

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

Electrophoretic deposition is a colloidal process in which ceramic particles, suspensed in a liquid medium, migrate in an electric field and deposit on an electrode. Here, we report on the optimization of the colloidal suspensions of commercially available nano-Y_2O_3 and successfully fabricated nano-$Y_3Al_5O_{12}$, in view of deposition of dense green bodies of these laser materials. Cylindrical green bodies were prepared in order to assess the feasibility of the method.

Ce^{3+} sensitized Nd^{3+} emission in garnet type structures

Stephanie Möller, Alexander Hoffmann, Thomas Jüstel

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

We will discuss influences of changes in the crystal field on the energy transfer from Ce^{3+} to Nd^{3+} and thus on the luminescence properties of Nd^{3+} incorporated in garnets co-doped with Ce^{3+}.

On translucent LuAG:Pr ceramics

Julian Plewa, Helga Bettentrup, Thomas Jüstel

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

LuAG:Pr is a well known luminescent material for application as scintillators. Translucent ceramics of LuAG:Pr have been prepared and characterized. Strong absorption in the VUV range, emission at around 310 nm (λ_{ex} =160 nm), and a decay time of 20 ns have been measured.

Neodymium-doped 8/65/35 PLZT ceramics for photonic applications, obtained by different sintering methods

Malgorzata Plonska[1], Wojciech A. Pisarski[2], Lukasz Cienki[1]

[1]University of Silesia, Faculty of Computer and Materials Science, Sosnowiec, Poland, [2]University of Silesia, Faculty of Mathematics, Physics and Chemistry, Katowice, Poland

Optical properties of Nd^{3+} ions in several host matrices such as glasses and transparent glass-ceramics depend on chemical composition, heat treatment conditions and preparation methods. In this work the influence of neodymium concentration (0-1at.%) and sintering conditions on 8/65/35 PLZT:Nd^{3+} ceramics were studied. All ceramic powders were synthesized by MOM technique and subsequently sintered by free sintering and hot uniaxial pressing method. Optimal conditions of PLZT:Nd^{3+} preparation as well as activator concentration were determined in relation to photonic applications.

Tuesday, 7th December

13:30 h **POSTER SESSION** - Continuation -

Diode-pumped intracavity KTP frequency-doubled Nd:YAG ceramic laser

Dingyuan Tang[1], Zhenhua Cong[1,2], Jian Zhang[3], Wei De Tan[1], Changwen Xu[1], Dewei Luo[1], Xingyu Zhang[2], Qingpu Wang[2]

[1]Nanyang Technological University, School of Electronics and Electrical Engineering, Singapore, [2]Shandong University, School of Information Science and Engineering, Jinan, P.R. China, [3]Nanyang Technological University, Temasek Laboratories, Singapore

The characteristics of a diode-pumped Nd:YAG ceramic laser and a KTP frequency doubled Nd:YAG ceramic laser are studied. At an incident pump power of 21.95 W, a 11.46 W 1064 nm CW laser is obtained with a 52.2% optical to optical conversion efficiency. By using a KTP crystal intracavity frequency doubling the Nd:YAG ceramic laser, a 3.6 W 532 nm laser is generated with an 21.95 W incident pump power. The corresponding conversion efficiency from diode laser to green laser is 16.4%.

Tuneable transparency in hydroxyapatite by varying sintering parameters and Strontium-doping

Syed Tofail[1], Abbasi Gandhi[1], Andrea Schatte[1,2], Jacek Zeglinski[1], Olga Korostynska[1], Michael Bredol[2]

[1]University of Limerick, Materials and Surface Science Institute, Limerick, Ireland, [2]Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

We demonstrate tuneable optical transparency in hydroxyapatite by varying sintering parameters and Strontium doping. This tuneable optical transparency along with its novel electrical properties can open up a number of important optical, opto-electrical and laser applications, additionally to its conventional bio-applications.

Peculiarities of nano-YAG synthesized by a glycothermal method

Mark Vorsthove[1], Thanh Huu Tran[1], Hellmut Eckert[2], Ulrich Kynast[1]

[1]Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany, [2]University of Münster, Institute of Physical Chemistry, Münster, Germany

YAG-nanoparticles, synthesized via the so called glycothermal method, were examined by size, optical properties and with solid state NMR-Techniques. Special attention was paid to the particle surface and the stability of the emission under irradiation.

Direct comparison of preparative methods for nano-YAG particles and derived ceramics

Mark Vorsthove, Tom Felbeck, Paul Motzek, Ulrich Kynast

Münster University of Applied Sciences, Department of Chemical Engineering, Steinfurt, Germany

We compared Europium and Cerium doped YAG-nanoparticles and ceramics on the basis of SEM, BET, XRD and optical measurements. The precursors were synthesized via glycothermal synthesis, reverse and urea precipitation, spray drying and the Pechini and citrate methode.

The effect of MgO and SiO_2 codoping on properties of Nd:YAG transparent ceramic

Hao Yang[1,2], Xianpeng Qin[2,3], Jian Zhang[2,3], Jan Ma[2], Dingyuan Tang[2], Shiwei Wang[3], Qitu Zhang[1]

[1]Nanjing University of Technology, College of Materials Science and Engineering, Nanjing, P.R. China, [2]Nanyang Technological University, Singapore, [3]Chinese Academy of Sciences, Shanghai Institute of Ceramics, Shanghai, P.R. China

High quality Nd:YAG transparent ceramics were fabricated by reactive sintering method under vacuum using both SiO_2 and MgO as compound sintering aids. The transmittance of the ceramic was still 82% at 400nm.

A fabrication process for Yb:YAG Ceramic and its lasing property

Jian Zhang[1,2], Dewei Luo[1], Xianpeng Qin[1,2], Hao Yang[1,3], Dingyuan Tang[1], Weide Tan[1], Zhenghua Cong[1], Changwen Xu[1], Shiwei Wang[2]

[1]Nanyang Technological University, Singapore, [2]Chinese Academy of Sciences, Shanghai Institute of Ceramics, Shanghai, P.R China [3]Nanjing University of Technology, Nanjing, P.R China

Vacuum reactive sintering method was employed to fabricate laser quality transparent Ytterbium doped yttrium aluminum garnet (Yb:YAG) polycrystalline ceramics. An uncoated 10 at.% Yb:YAG ceramic was pumped by a 940 nm diode laser. Under a maximum incident power of 11.79 W, 1.65 W output power was produced at a wavelength of 1030 nm, which corresponds to a 19.6% slope efficiency.

Fabrication and properties of highly transparent Er:YAG ceramics

Jian Zhang[1,2], Xianpeng Qin[1,2], Hao Yang[1,3], Dewei Luo[1], Jan Ma[1], Dingyuan Tang[1], Shiwei Wang[2]

[1]Nanyang Technological University, Singapore, [2]Chinese Academy of Sciences, Shanghai Institute of Ceramics, Shanghai, P.R China [3]Nanjing University of Technology, Nanjing, P.R China

Highly transparent Er:YAG ceramics with different doping concentration were fabricated by a solid-state reactive sintering method using commercial Al_2O_3, Y_2O_3 and Er_2O_3 powder as starting materials. For 3 mm thickness samples, the in-line transmittances at the wavelength of 1100 nm and 400 nm were about 84% and 82% respectively.

Luminescence properties of $MgAl_2O_4$ nanoceramics doped with Eu^{3+} prepared by a high pressure sintering technique: effect of grain size and strains.

A. Bednarkiewicz, A. Lukowiak, P. Głuchowski, W. Strêk

Polish Academy of Sciences, Institute of Low Temperature and Structure Research, Wroclaw, Poland

Eu^{3+}:$MgAl_2O_4$ and Na^+, Eu^{3+}:$MgAl_2O_4$ nanoceramics have been obtained by a low temperature/high pressure sintering process (LTHP). The structural properties have been studied by X-ray diffraction (XRD). The grain sizes and R.M.S micro-strains have been calculated by Rietveld method based on the XRD patterns. The photoluminescent properties of nanoceramics were investigated by excitation and emission spectroscopy at room and low temperature (77 K). The f-f transitions characteristic for Eu^{3+} ion were observed and emission lifetimes were measured. The Judd–Ofelt theory has been performed to explain a detailed analysis of luminescence spectra.

Tuesday, 7th December

15:00 h

Strength and strengthening of polycrystalline (ceramic) laser components (invited)

Yehoshua Shimony[1,2], Revital Feldman[1]

[1]Soreq NRC, Applied Physics Division, Yavne, Israel, [2]Ben-Gurion University of the Negev, Department of Materials Engineering, Beer-Sheva, Israel

Crystalline laser components may fracture under high thermally induced stress. In the present paper, ways to evaluate the tensile strength of σ_f crystalline and poly-crystalline laser components will be discussed, as well as paths to enhance its strength.

15:25 h

Specificity of thermal effects in laser ceramics as compared to single crystals: theory and experiments (invited)

Efim Khazanov

Institute of Applied Physics, Nizhny Novgorod, Russia

We review theoretical predictions and experimental confirmations of strong statistical dispersion of thermal lensing and thermally induced depolarization in ceramics. This effect is specific to ceramics and has no analogues either in glasses or in single crystals.

15:50 h

Simple method to join YAG ceramics and crystals

V.B. Kravchenko[3], S. N. Bagayev[1], A. A. Kaminskii[2], Y. L. Kopylov[3], I. M. Kotelyanskii[3]

[1]Russian Academy of Sciences, Institute of Laser Physics SB, Novosibirsk, Russia, [2] Russian Academy of Sciences, Institute of Crystallography, Moscow, Russia, [3] Russian Academy of Sciences, Institute of Radio Engineering and Electronics named after V .A. Kotelnikov, Fryazino, Russia

Method to join samples of YAG ceramics and crystals with flat polished surfaces together with no visible border between the samples includes deposition of SiO2 layer(s) on the surfaces to be joined and heating the joined samples above 1700 oC.

Wednesday, 8th December

09:00 h

Comparative investigation of cw and Q-switched laser characteristics of Yb:YAG ceramics and crystals (invited)

Jun Dong

Xiamen University, School of Information Science and Technology, Department of Electronic Engineering, Xiamen, China

CW and Q-switched laser performance of Yb:YAG ceramics and single-crystals was investigated systematically. The effects of Yb concentration, the output coupling and different combinations of Yb:YAG, Cr, Ca:YAG crystals and ceramics on the cw and passively Q-switched laser characteristics were addressed.

09:25 h

Towards ultra high intensity lasers (invited)

Ken-ichi Ueda

Institute for Laser Science, Univ. of Electro-Communications, Chofu, Tokyo, 182-8585 Japan

To discover high field sciences, ultra-high power solid state lasers, 100 fs, 15 kHz, and 3 MW in average power are required. New concepts proposed for ICFA (International Committee on Future Accelerators) and ICUIL (International Committee of Ultra-high Intensity Lasers) will be discussed in the meeting.

09:50 h

Improvements in the processing of Yb:YAG ceramic materials

Marina Serantoni[1], Laura Esposito[1], Andreana Piancastelli[1], Daniele Alderighi[2], Angela Pirri[2]

[1]ISTEC-CNR, Istituto di Scienza e Tecnologia dei Materiali Ceramici, Faenza (RA), Italy [2]IFAC-CNR Istituto di Fisica Applicata "Carrara",Sesto Fiorentino (FI), Italy

This study focuses on the optimization of the powder processing of Yb:YAG ceramics. An innovative spray drying process of solvent-based suspensions is adopted for the preparation of ready-to-press powders. The influence of the experimental conditions on morphology of granulated powders, on microstructure evolution during sintering and transparency, is described.

10:10 h

Processing control for fabricating high quality Nd:YAG ceramics (invited)

Jian Zhang[1,2], Xianpeng Qin[2], Hao Yang[2], Dewei Luo[3], Hua Gong[1], Dingyuan Tang[3], Jan Ma[1], Shiwei Wang[2]

[1]Nanyang Technological University, Temasek Laboratories, Singapore, [2]Chinese Academy of Sciences, Shanghai Institute of Ceramics, P.R China, [3]Nanyang Technological University, School of Electronics and Electrical Engineering, Singapore

In this research, the effects of stoichiometry, sintering aids, and sintering conditions on microstructure and further the optical quality of the sintered ceramics will be discussed. By optimizing the processing parameters, high optical quality YAG ceramics are fabricated successfully.

11:05 h

Growth of optical grade yttrium oxide single crystal via ceramic technology

Maxim Ivanov, Irina Vyukhina, Vladimir Khrustov

Russian Academy of Sciences, Institute of Electrophysics, Ekaterinburg, Russia

The presentation deals with growth of Nd^{3+}:Y_2O_3 (NDY) single crystal via ceramic process. Samples of NDY single crystal were produced. Defects formed in the samples were investigated. Conditions that are necessary for abnormal grain growth in yttrium oxide as well to grow the optical grade single crystal are discussed.

11:25 h

Optical ceramics for solid state lighting (invited)

George Wei, M. Raukas

Osram Sylvania, Beverly, MA, USA

Solid-state lighting utilizes new optical ceramics such as Ce-doped garnets to either combine emissions from the LED and ceramic for high-brightness white light or fully convert to pure color. Precision fabrication achieves efficient luminescent ions, host lattice, and favorable absorption/emission.

11:50 h

The influence of anions during micro-jet-reactor precipitation of YAG-powders on powder properties and resulting microstructure

Daniel Ganzer[1], Jan Werner[1], Ralf Diedel[1], Lothar Ackermann[2], Mathias Gerrmann[2]

[1]Research Institute for Inorganic Materials – Glass/Ceramics GmbH, Hoehr-Grenzhausen, Germany, [2]Research Institute for Mineral and Metal Materials – Gemstones/Noble Metals GmbH, Idar-Oberstein, Germany

Nano-scaled YAG-precursor powder with high chemical purity is produced by Micro-Jet-Reactor precipitation technique. The influence of the anion component during precipitation on powder properties is clarified and the resulting microstructure of the vacuum sintered and hot isostatic pressed ceramics is described.

13:30 h

Fabrication of transparent nanoceramics through controlled amorphous crystallization

Jiangtao Li, Lin Mei, Guanghua Liu

Chinese Academy of Sciences, Technical Institute of Physics and Chemistry, Beijing, P. R. China

Transparent $LaAlO_3/ZrO_2$ and YAG/HfO_2 composite nanoceramics have been prepared through viscous sintering and controlled crystallization. By this method, the densification can be separated from grain growth and thus nanoceramics can be produced.

Wednesday, 8th December

13:50 h

Transparent hydroxyapatite ceramics with piezo and pyroelectricity

Syed A. M. Tofail, Abbasi A. Gandhi, Olga Korostynska, Colm Johnson

University of Limerick, Materials and Surface Science Institute, Limerick, Ireland

We report high level of optical transparency and significant piezo and pyroelectric effect on spark plasma sintered hydroxyapatite ceramics as well as their mass production technique. These new properties in hydroxyapatite can open up important bio-optic applications of hydroxyapatite in addition to its conventional applications.

14:10 h

Phase controlled stimulated Brillouin scattering phase conjugate mirror and its application to a coherent four-beam combination (invited)

Jin Hong Kong, Sangwoo Park, Seongwoo Cha

Korea Institute of Science and Technology, Daejeon, Republic of Korea

Coherent four-beam combination using the self-phase controlled stimulated Brillouin scattering phase conjugate mirror is constructed. With the wavefront dividing method and the amplitude dividing method, the phase fluctuations between the SBS beams are well-stabilized when the amplifiers are operating.

14:35 h

Characterisation of optical components by means of time-of-flight secondary ion mass spectrometry

Birgit Hagenhoff, Elke Tallarek, Reinhard Kersting

Tascon GmbH, Münster, Germany

For development or failure analysis of optical materials a sensitive analytical technique is required. We will show that ToF-SIMS (Time-of-Flight Secondary Ion Mass Spectrometry) is a well suited screening tool for chemical characterization directly at the solid surface, in deeper layers and in a complete 3-dimensional volume.