LuAG:Pr is a widely applied luminescent material which can be excited by γ- and x-rays as well as by UV and visible radiation. The short decay time in the nanosecond range of the spin allowed $^{4}S_{3/2} \rightarrow ^{4}P_{1/2}$ transition of the activator and the high stability of the material are of particular interest for many application areas, e. g. as a scintillator. Single crystalline LuAG:Pr has been intensively studied. Even though there is a great demand for rare earth doped LuAG single crystals as scintillators and solid state laser materials they lack in utilization of their capacity due to the high costs for these crystals. Additionally, polycrystalline transparent ceramics of rare earth doped LuAG have been prepared and investigated in order to obtain a new optical material for various applications.

In this work, translucent ceramics of LuAG:Pr have been prepared and characterized. To this end, a nanoscale powder obtained by a combustion method with trisamine as fuel was mechanically compacted and sintered. The powder comprising soft agglomerates of about 10 - 20 µm in size (primary crystals of about 100 nm was densified in two steps by uniaxial and subsequently by isostatic cold pressing without any additives. The obtained green bodies with a theoretical density of more than 50% were sintered at 1700 °C in air. All ceramics show good transluency, but are not transparent yet. However, excitation the ceramics by a blue LED, yielded a greenish-white spectrum due to the conversion of the blue LED light into a multinline spectrum between 480 and 650 nm.

Conclusions

Optical transitions between the $^{4}S_{3/2} \rightarrow ^{4}P_{1/2}$ configuration and the ground state levels $^{4}I_{5/2}$, $^{4}I_{11/2}$, $^{4}I_{15/2}$, and $^{4}I_{19/2}$ of the $^{4}I_{15/2}$ configuration of Pr$^{3+}$ results in UV luminescence. In contrast, optical transitions between energy levels of the $^{4}I_{15/2}$ configuration of Pr$^{3+}$ are located in the visible range. The absorption lines located at 450 - 480 nm ($^{4}I_{5/2} \rightarrow ^{4}P_{1}$) and 580 - 610 nm ($^{4}I_{9/2} \rightarrow ^{4}D_{2}$) cause the light green body color of LuAG:Pr ceramics. It turned out that excitation by 450 nm radiation results in a whitish spectrum, that consists of a multinline of lines caused by $^{4}I_{15/2} \rightarrow ^{4}I_{11/2}$ transitions of Pr$^{3+}$. The rather strong absorption at 450 nm allows the application of such ceramics as colour converters onto LED dies too. The further enhancement of the transparency of garnet type ceramics will be in the focus of our future research.