Synthesis and structure of Ln_2MoO_6 (Ln = La, Gd)

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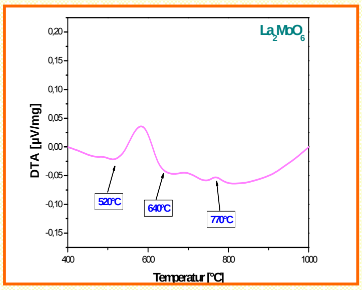
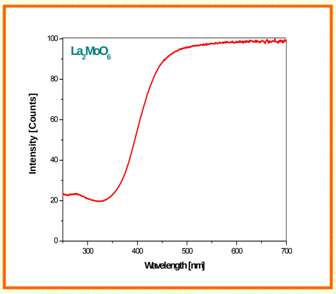
Introduction

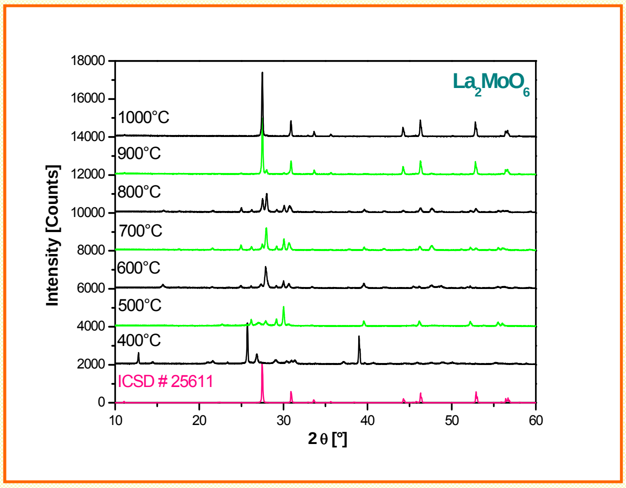
For many years complex oxides of composition Ln_2MoO_6 were of interest because of their catalytic[1,2] and optical properties. Ln_2MoO_6 compounds depending on the radius of Ln cation and the synthesis conditions, have been reported to crystallize in three polymorphs with monoclinic (α), cubic (β) and tetragonal (γ) symmetries[3]. The goal of this work was the synthesis, optical and crystal study of La_2MoO_6 and Gd_2MoO_6.



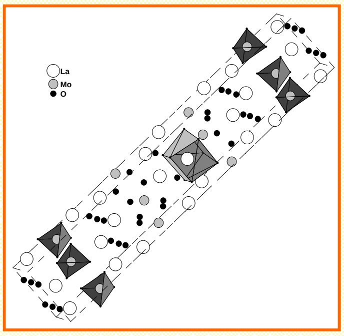
a) DTA of La_2O_3 / MoO_3 composition



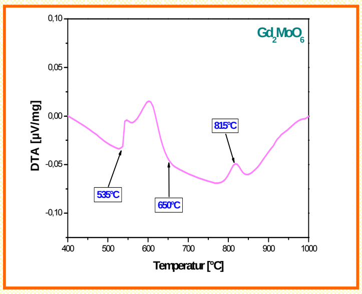
b) Reflection spectrum of La_2MoO_6



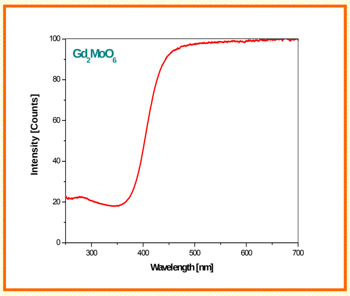
c) Powder diffraction patterns of La_2MoO_6



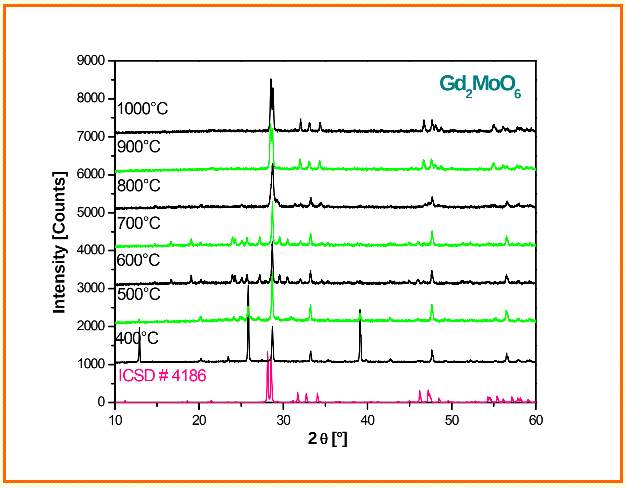
d) Unit cell with coordination polyhedron of La_2MoO_6 system



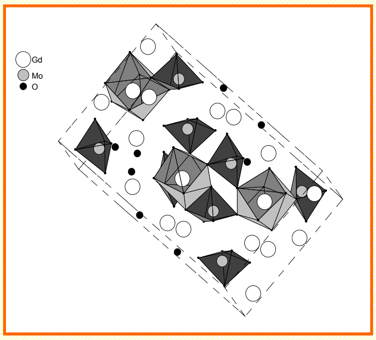
a) DTA of La_2O_3 / MoO_3 composition



b) Reflection spectrum of Gd_2MoO_6



c) Powder diffraction patterns of Gd_2MoO_6



d) Unit cell with coordination polyhedron of Gd_2MoO_6 system

Conclusions

The results show, that the structure depends on interplay among the atomic sizes of Ln and the synthesis temperature. The α phase was most stable for small lanthanides at low synthetic temperatures whereas the γ phase was preferred by large lanthanides. The polymorphic phase transitions of (α)↔ (β)↔ (γ) occurring in the Ln_2MoO_6 system can be discussed in terms of metal-oxygen cluster-exchange mechanism[4].
Absorption edge respectively for La_2MoO_6 and Gd_2MoO_6 was 340nm (white powder) and 378nm (white powder).
These materials might find application as optical filters and as gain media for solid state LASERs.

References:
(1) F. De Smet, P. Ruiz, B. Delmon, M. Devillers, J. Phys. Chem. B 105, 12355 (2001).
(2) D.J. Buttrey, T. Vogt, U. Wildgruber, W.R. Robinson, J. Soild State Chem. 111, 118 (1994).
(3) P.V. Klevtsov, L.Y. Kharchenko, R.F. Klevsova, Sov. Phys. Crystallogr. 20, 349 (1975).
(4) J.S. Xue, M.R. Antonio, L. Soderholm, Chem. Mater. 7, 333 (1995).

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