

Goal of the project:

The project suggests several innovative solutions to optimize the combustion method, thus allowing the preparation of nanocrystalline compounds of practical interest, with large surface area, such are: BaAl_2O_4 , Al_2TiO_5 , ZnAl_2O_4 , LaAlO_3 or YAlO_3 .

Short description of the project:

Preparation of ceramic powders with controlled properties under more advantageous conditions is a real challenge for the field of ceramics. One of the recently developed synthesis methods is the solution combustion synthesis, which in some cases yields the designed crystalline compounds directly from the combustion reaction, no further annealing being necessary.



BaAl_2O_4 combustion synthesis evolution

However, in some cases, the initial version of the combustion method does not lead to satisfying results. Often, the reaction products are amorphous and/or contain residual carbon. Therefore, the formation of the desired phase may be achieved only after a subsequent annealing, which leads to grain growth and low surface area powder.

Novel solutions are approached within the project, in order to optimize the original version of combustion synthesis: the use of new organic fuels; the use of fuel mixtures; the removal of residual carbon by hydrogen peroxide chemical oxidation; the use of passive retarding salt additions; the use of metal nitrate/fuel molar ratios with fuel excess.

Project implemented by:

„Politehnica” University of Timisoara

Implementation period:

10.2011 – 09.2014

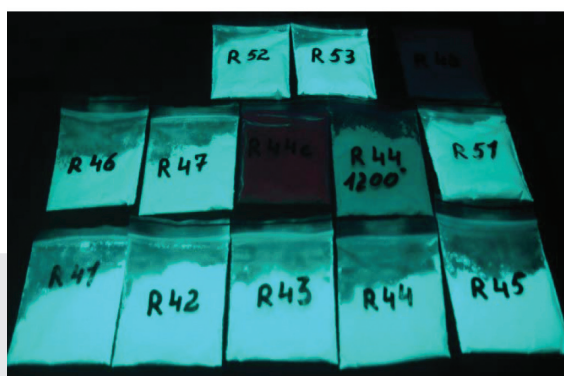
Main activities:

Management and communication:

Conducting the public procurement procedures. / Preparation of intermediate and final progress reports. / Monitoring and internal control of the project implementation process. / Results processing and elaboration of scientific materials (articles, OSIM patent application, posters, presentations). / Results dissemination and attending international conferences. / Creating and updating a project web site.

Research:

- increasing the surface area of ZnAl_2O_4 powders by **removing the residual carbon via H_2O_2 oxidation**
- combustion synthesis of nanocrystalline BaAl_2O_4 powders, with large surface area, **using new organic fuels**



$\text{Eu}^{2+}/\text{Dy}^{3+}$ -doped BaAl_2O_4 phosphor materials obtained within the project.

“Research consists in seeing what everyone else has seen, but thinking what no one else has thought.”

Albert Szent-Gyorgyi

- study: the influence of passive retarding (moderator) salt additions on the combustion synthesized LaAlO_3 powders
- study: the use of fuel mixtures in the solution combustion synthesis of YAlO_3 powders
- combustion synthesis of pure and doped Al_2TiO_5 powders

Results (by 01.01.2013):

1. Literature study on zinc spinel (Ro)
2. Project site at:
<https://sites.google.com/site/proiectpniiru>
[te201130024/](https://sites.google.com/site/proiectpniiru/te201130024/) and
<http://www.upt.ro/pfe10.php>
3. Scientific paper: Robert Ianos, Radu Lazău, Ioan Lazău, Cornelia Păcurariu, **Chemical oxidation of residual carbon from ZnAl_2O_4 powders prepared by combustion synthesis**, Journal of the European Ceramic Society, <http://www.sciencedirect.com/science/article/pii/S0955221911006777> (Impact Factor 2010: 2.574, Relative score of influence, January 2012: 5.932)
4. Scientific paper: Robert Ianos, Radu Lazău, Roxana Băbută, Silvana Borcănescu, Cristian Renato Boruntea, **Nanocrystalline BaAl_2O_4 powders prepared by aqueous combustion synthesis**, Ceramics International, <http://www.sciencedirect.com/science/article/pii/S0272884212008802> (Impact Factor 2010: 2.574, Relative score of influence, January 2011: 1.751)

Fields of interest:

Materials science, ceramic powder preparation, combustion synthesis.

Financed through/by:

UEFISCDI, Executive Agency for Higher Education, Research, Development and Innovation Funding Human Resources

PROGRAMME, Research projects for the stimulation of the funding of young independent research teams (TE)

Research team:

Project leader: Ianos Robert
Researcher: Lazău Radu
Researcher: Borcănescu Silvana
Researcher: Băbută Roxana

Research centre for Environmental Science and Engineering

Aplicability and transferability of the results:

Given the novelty of the suggested solutions, the project is expected to have a high impact and lead to remarkable scientific and economical results in terms of sustainable development. The results obtained within the project will be disseminated as scientific papers in ISI – ranked publications or communicated within relevant international conferences. Some of the results and conclusions will be also included in the teaching activities performed by members of the implementation team at “Politehnica” University of Timisoara.

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