The main objective of the project is to develop methods of preparation of nanocrystalline strontium cerium oxide (Sr_2CeO_4) and to investigate how method of synthesis affect grain sizes, morphology, crystal structure and optical properties of the studied material.

Sr_2CeO_4 was selected to this investigation due to its relatively newly discovered material with unique optical properties. At first time it was synthesized and described by Danielson in the end of last century [1,2]. The studies carried out by him showed that emission spectra of strontium cerium oxide presented intense and broad band. Their origin is associated with the electron transfer between ions of cerium(IV) and oxygen. Due to the fact that chemical compounds require for synthesis of Sr_2CeO_4 are relatively easily available and annealing temperature is low causes that strontium cerium oxide is a very attractive material with high potential for application especially in nanocrystalline form. In the literature there are number of reports about Sr_2CeO_4 with micrometer grain size [3]. Our research shows that preparing pure phase of strontium cerium oxide as nanocrystals is possible [4]. This is extremely important because a relatively large number of atoms located on the nanocrystal surface in relation to number of atoms in its volume may result in a change of intensity on already known or occurrence of new phenomena such as: changing the intensity of absorption bands, changing of luminescence decays or impact of atmosphere on optical properties of dopants [4].

Particular aim of the project is to answer how the size of separated particles of luminophore influences on the recently reported broadband white light emission not induced as for conventional light sources usually under high energy excitation, but excited with infrared laser diode beam [5].

The first stage of proposed research will be connected with optimization of three different synthesis methods of the Sr_2CeO_4 as a function of average grain size and detail structural analysis of obtained materials by powder diffraction patterns (XRD) and images of transmission electron microscope (TEM). The second stage of proposed research will be related with spectroscopic characterization of the samples. The analysis will be consist of measurements of emission spectra and luminescence kinetics of strontium cerium oxide prepared with different methods as a function of average grain size.

First publications about broadband anti-Stokes white emission have been published in 2010. Peter Tanner et al. from Hong Kong University, discovered that placing lanthanide oxide in strictly defined conditions under infrared excitation generate intense broadband white emission [5]. Since that time, despite number of reports about registration this phenomena for other compounds [6], still missing full description of mechanism leading to observe this kind of emission. Therefore, it is necessary to conduct more basic research which will contribute to broadening knowledge about this phenomenon.

Light plays a very important role in the life of human being. It affects our well-being, mood or time of day activity. Inadequate lighting can cause discomfort or even diseases. In last few years, the light sources undergo large metamorphosis. The main goal is to produce energy efficient and durable light source with best possible properties. This is partially related with the European Union directive according to which Poland should reduce their electricity consumption by 20 % to 2020. Currently available light sources emits cold and unpleasant color as a result of combination of several colors. Therefore, it is desirable to obtain a phosphor which itself emit white warm light.

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[1] E. Danielson, M. Devenney, D.M. Giaquinta, J.H. Golden, R.C. Haushalter, E.W. McFarland, D.M. Poojary, C.M. Reaves, W.H. Weinberg, X.D. Wu, *Science*, **279** (1998) 837.

[2] E. Danielson, M. Devenney, D.M. Giaquinta, J.H. Golden, R.C. Haushalter, E.W. McFarland, D.M. Poojary, C.M. Reaves, W.H. Weinberg, X.D. Wu, *J. Mol. Struct.*, **470** (1998) 229.

[3] X.M. Liu, Y. Luo, J. Lin, *J. Cryst. Growth*, **290** (2006) 266.

[4] M. Stefanski, L. Marciniak, D. Hreniak, W. Strek, *J. Chem. Phys.*, 1**42** (2015) 184701.

[5] J. Wang, P.A. Tanner, *J. Am. Chem. Soc.*, **132** (2010) 947.

[6] Y. Zhu, W. Xu, C. Li, H. Zhang, B. Dong, L. Xu, S. Xu, H. Song, *Appl. Phys. Express*, **5** (2012) 092701.