Cavity: Analysis and Application of Nanostructures in Aluminumoxide

Hensel, Arne

This project in its present form is the result of electrochemical production, analysis with new optical methods and application of aluminumoxide for a new electroluminescent device. The initial idea was to determine the influence of different parameters at the manufacturing process of nanoporous layers and to design my own nanostructures. The system of nanoporous aluminum oxide was chosen for experimentation because of it`s simple handling and manufacturing. Lateral dimensions of the nanostructures were determined by scanning electron microscopy. The layers were produced in sulfuric acid, phosphoric acid, oxalic acid at different ranges of applied voltage, concentration of the acid and temperature. A regular pattern of 50nm nanostructures can be produced by anodizing pure aluminum in 0.2 mol/L sulfuric acid over 24h at a volatege of 12V and 0°C. To determine porediamter and thickness of produced layers optical methods instead of elecronical methods like AFM and REM or SEM were invented. With organic molecules as fluorescent markers deposited in the nanopores by adsorption of solulable dyes, it was possible to calculate the porediameter through photospectroscopy. Also white-light interferometry and ellipsometry was used to measure porediameter and thickness of the layer. Additionally a new light emitting device was produced by electrical excitation of organic dyes withinn the pores by alternating currents. The contributions of this project are twofold. First, the parameters of nanoporous aluminumoxide layers were determined. Secondly, the "proof of concept" of a new nanoscaled light emitting device were presented.

Awards Won:

First Award of $5,000

Intel ISEF Best of Category Award of $5,000

Arconic Foundation: Fourth Award of $500