REACTION/DIFFUSION FRONTS IN CATALYTIC CO OXIDATION ON μm-SIZED Pt(110) AND Pt(100) DOMAINS : A COMPARATIVE PEEM STUDY

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The CO oxidation reaction on individual μm-sized (110)- and (100)-type grains of a polycrystalline Pt foil was studied *in situ* using photoemission electron microscopy (PEEM) to deduce locally-resolved reaction kinetics [1]. The PEEM monitoring of the reaction front propagation reveals a high degree of propagation anisotropy for oxygen and CO fronts on both, anisotropic Pt(110) and on the apparently isotropic Pt(100) surface. The degree of anisotropy is temperature-dependent and the anisotropy vanishes for oxygen fronts on Pt(100) at temperatures above 465 K, but remains for CO fronts at all temperatures studied in the range of 417 to 513 K. A change in the front propagation mechanism is proposed to explain the observed effects. The local PEEM intensity distribution is modeled based on the adsorbate surface densties in the reaction front zone. In parallel, the reaction-induced surface morphologic changes were studied by optical differential interference contrast microscopy and by atomic force microscopy (AFM), with the corresponding results being discussed in view of the PEEM data. Present results obtained on the individual μm-sized grains of polycrystalline Pt are compared with earlier observations for corresponding single crystal surfaces [2].

[1] Y. Suchorski, C. Spiel, D. Vogel, W. Drachsel, R. Schlögl, G. Rupprechter, Chem. Phys. Chem. **11** (2010) 3231.
[2] G. Ertl, Angew. Chem. Int. Ed. **47** (2008) 3524 (Nobel Prize lecture) and references therein.

NANOSTRUCTURED ANTIREFLECTION LAYERS ON GaN FOR ENHANCING LIGHT EXTRACTION FROM LIGHT-EMITTING DIODES

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We describe the fabrication and characterization of a randomly etched gallium nitride (GaN) surface for enhancing light extraction from light-emitting diodes (LEDs). Light-emitting semiconductor devices often suffer from the mismatch of refractive index between the semiconductor material and the outside medium, which prevents a large fraction of generated light from escaping outside planar waveguide. Here we describe a novel technique for achieving refractive index matching between GaN – a widely used semiconductor for making blue and ultraviolet LEDs – and ambient air. Our technique is based on creating a graded refractive index zone at the top surface of GaN LED wafer by creating a meso-porous surface. The textured surface acts as a graded refractive index (GRIN) layer with antireflection (AR) properties. Our technique uses silica spheres as nano-targets in a sputter-etch process and produces a fine-grained nano-roughened surface with average feature size around 35 nm [1]. Optical characterization of samples (active GaN/InGaN MQWs wafer emitting at the wavelength of 453 nm) was performed using angle-resolved photoluminescence (PL) spectroscopy. Measurements show that photoluminescence intensity from such treated surfaces on a GaN LED wafer increases 2.2 times over that from pristine surfaces. Additionally, the angular emission was observed to be featureless, without any secondary lobes, thus producing uniform brightness suitable for solid-state lighting applications.

[1] R. Dylewicz et al., Nanotechnol. **22**, 055301 (2011).