Helium Ion Microscopy Focus Topic
Room: Hall B - Session HI-ThP

Aspects of Helium Ion Microscopy Poster Session

HI-ThP2 Imaging Nascent Soot Particles: Tiniest Soot Particles are Not Structurally Homogeneous, *M. Schenk,* Bielefeld University, Germany, ***S. Lieb***, University of Southern California, *H. Vieker, A. Beyer, A. Gölzhäuser,* Bielefeld University, Germany, *H. Wang,* University of Southern California, *K. Kohse-Höinghaus,* Bielefeld University, Germany

Structural and morphological probing of nascent soot has been a challenging problem historically. Transmission electron microscopy (TEM) shows that mature soot is usually composed of stacks of polycyclic aromatic hydrocarbons arranged in a turbostratic fashion with a certain degree of microscopic crystallinity. Whether this observation can be extrapolated to nascent soot undergoing rapid mass and size growth in a flame remains an open question. In particular, recent studies show converging evidence that nascent soot may have an aromatic core-aliphatic shell structure not seen from previous TEM studies. The aliphatic component in the shell appears to be weakly bound among itself and with the aromatic core. In TEM probing, the possibility of high-energy electron beam damage or structural modification particles also remains an open question. Evidence of this possibility emerged as early as the mid 1980s when Iijima (S. Iijima, J. Electron Microsc, 34 (1985) 249-265) demonstrated the structural instability of gold nanoparticles ~3 nm in diameter under electron beam irradiation in a TEM. Sample damage can arise from electron beam induced chemical bond breaking and/or evaporation of the aliphatic component along with structural change and crystallization of the remaining particle material.

To explore the aforementioned problems and to find more suitable techniques, we report here results of two "softer" microscopic techniques: Helium Ion Microscopy (HIM) and phase imaging Atomic Force Microscope (AFM). In comparison to TEM, both techniques present far less sample damaging during imaging. The present study focuses on the HIM imaging of nanometer-sized soot particles sampled from a stagnation-point ethylene-oxygen-argon flame, under the conditions of Abid et al. (A. D. Abid, Combust.Flame 154 (2008) 775-788).

HI-ThP3 Helium Ion Microscopy as a Tool to Investigate Thin Layer Thicknesses, *H. Vieker, K. Rott, U. Werner, A. Beyer, G. Reiss,* ***A. Gölzhäuser***, Bielefeld University, Germany

The recently developed helium-ion microscope allows remarkable surface resolution with the secondary-electron (SE) detector. Simultaneously, backscattered ions can be detected that allow imaging with a substantially higher elemental contrast. This Rutherford backscattered ion (RBI) contrast depends mainly on the elemental composition of the investigated sample surface. The escape depth of backscattered ions is much larger than for secondary electrons. Thus whole layers with a wide range of thicknesses will contribute to a RBI image, whereas the SE image is far more surface sensitive.

In this contribution we examine RBI imaging as a tool to characterize thickness variations of layered samples with well defined compositions. The homogeneity of gold layers on silicon substrates is investigated and compared to simulations. The achievable spatial resolution as well as the use of reference samples to measure layer thicknesses will be addressed.

HI-ThP4 Helium Ion Microscopy and Ionoluminescence of Defects, ***G. Hlawacek***, *V. Veligura, R. van Gastel, H.J.W. Zandvliet, B. Poelsema*, University of Twente, Netherlands

Defects are an unavoidable and often unwanted side product of Helium Ion Microscopy (HIM). We will discuss the role of defects and try to show examples of their useful application.

Point defects created using HIM can be analyzed in-situ using ionoluminescence. However, such point defects can also be exploited to create areas with specific optical properties, in particular areas that either absorb light or emit light of a certain wavelength when exited.

Going beyond normally used ion doses allows to investigate defect agglomeration, blister formation and the subsequent surface restructuring. We present examples of materials modification at doses starting from $1x10^{17}$cm^{-2} up to $1x10^{22}$ cm^{-2}. Examples of surface structures formed under extreme ion fluencies at different temperatures will be presented for a wide range of materials including technological relevant materials for nuclear applications.

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