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Secondary Neutral and Ion Mass Spectrometry with Swift Heavy Ion Projectiles

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Mass spectrometry of atoms and molecules desorbed from a solid surface under bombardment with energetic particles provides a versatile method for chemical surface and in-depth analysis. Typical commercial applications involve the use of keV projectile ions and analyze the flux of electrically charged secondary particles (Secondary Ion Mass Spectrometry SIMS). The collisional sputtering process initiated by such projectiles, however, often generates a significant amount of chemical damage both at the surface and in the sputtered material, so that it has been suggested to utilize the *electronic* sputtering process initiated by a swift heavy ion (SHI) impact in order to minimize molecular fragmentation ("MeV-SIMS"). Moreover, the vast majority of the sputtered material is generally emitted in a neutral state, thereby asking for a suitable post-ionization method in order to render these particles accessible to mass spectrometric analysis (Sputtered Neutral Mass Spectrometry SNMS). We have recently implemented a new time-of-flight mass spectrometer at the GSI UNILAC beam line which enables a combined SIMS/SNMS analysis of material sputtered under SHI impact. First applications of this system have delivered a wealth of data regarding the composition and charge state of the sputtered material, thereby providing valuable insight into the SHI-induced sputtering process. The data also indicate a nearly fragment-free desorption of intact neutral parent molecules from selected SHI-irradiated organic films.

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