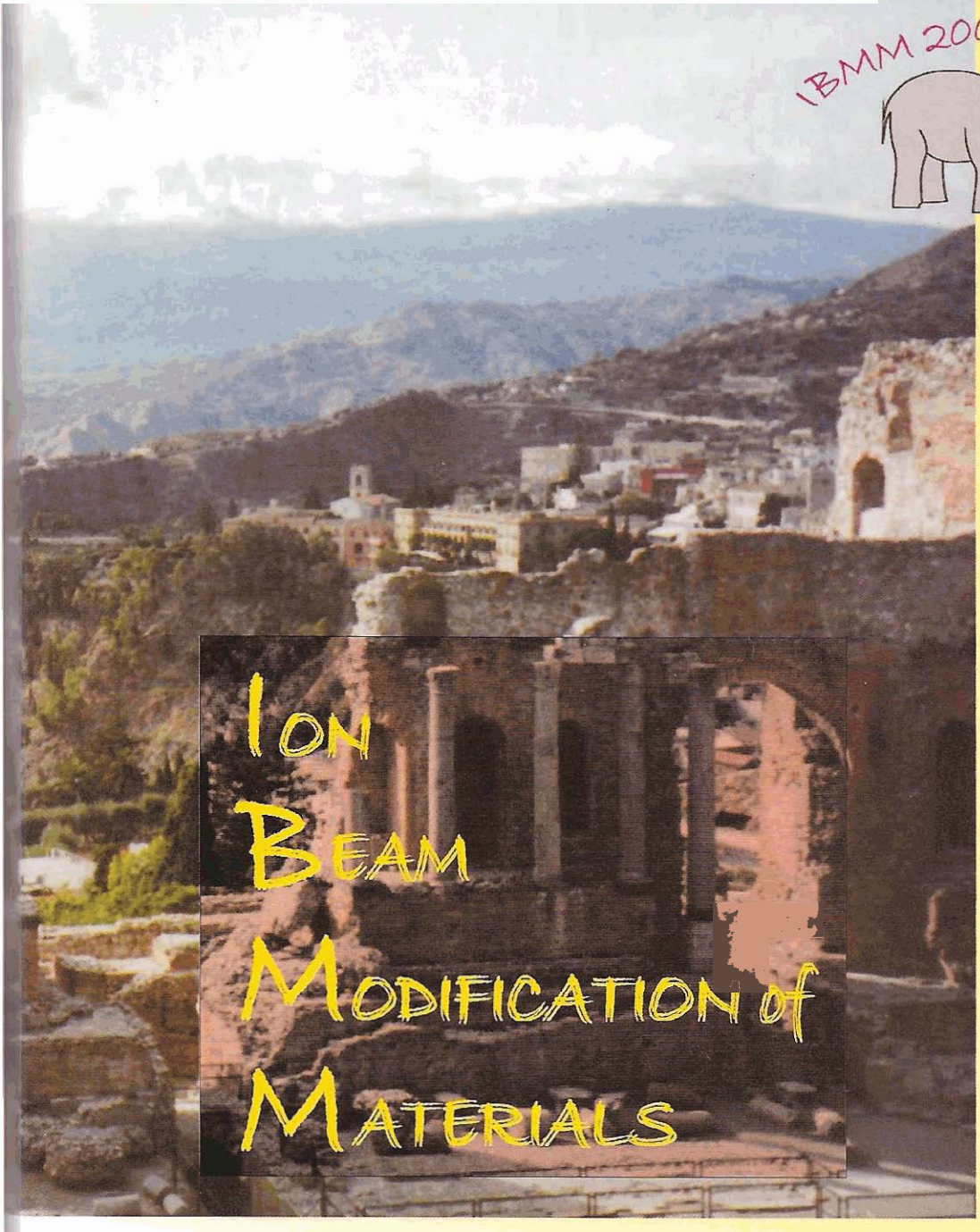

IBMM 2006

Ion Beam Modification of Materials

Program and Abstracts

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Broad beam gas ion source with hollow cathode discharge and four-grid accelerator system

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A broad beam gas ion source based on low-pressure hollow cathode glow discharge is described. An axial magnetic filed produced by AlNiCo permanent magnets enhances the glow discharge in the ion source as a result of the magnetizing electrons between the hollow cathode and rod anode. The gas plasma is produced by magnetron hollow cathode glow discharge in the hollow cathode and a collimated broad ion beam is extracted by a four-grid accelerator system. A weak magnetic field of several millitesla is enough to ignite the magnetron glow discharge at pressure lower than 0.1 Pa, thereby enabling stable and continuous high-current discharge to form the homogeneous plasma. A four-grid accelerator, which separates the extraction and acceleration of the ion beam, is used here to obtain the high-energy ion beam from 10 keV to 60 keV at a working pressure of 10^{-2} Pa. Although a higher gas pressure is necessary to maintain the low-pressure glow discharge compared to hot filament discharge, the hollow cathode ion source can work with reactive gases such as oxygen in the high-voltage continuous mode. A laterally uniform ion beam can be achieved by using the four-grid accelerator system. The effects of the magnetic field strength and rod anode length on the characteristics of the plasma discharge as well as ion beam extraction from the ion source will be discussed.