

Energy loss of 50-GeV uranium ions in natural diamond

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APPLIED PHYSICS A- MATERIALS SCIENCE & PROCESSING 80 (2005) 691-694

This work is motivated by heavy-ion irradiation of materials exposed to high hydrostatic pressures in a diamond anvil cell (DAC). Those studies require the complete passage of ions through one of the two anvils consisting of natural diamond. Due to typical anvil lengths of about 2 - 3 mm, ion energies of a few hundred MeV/u, as provided by the SIS heavy-ion synchrotron of GSI, are needed. Data of energy loss and range of ions in this energy regime being scarce for diamond, a set of experiments was devoted to range measurements by irradiating a single DAC diamond and an immediately following stack of 100 polycarbonate foils (each 30- μm thick) with ^{238}U ions of 50.3 GeV (211.5 MeV/u). Ion range and range straggling in the stack were determined by etching the tracks and counting the pores. The experimentally determined ion range in the polymer foil stack is consistent with energy-loss values in diamond and polymer obtained with the SRIM and ATIMA computer codes and also confirms the reliability of these codes for diamond. Therefore, SRIM and ATIMA will be used in further experiments aimed at heavy-ion irradiation of materials pressurized in DACs.