Projectile Neutralization during Large-Angle Backscattering of Slow F^{q+}, Ne^{q+}, and Ar^{q+} Incident on RbI(100)

F. W. Meyer, H. F. Krause and C. R. Vane

Physics Division, Oak Ridge National Laboratory, Oak Ridge, TN USA 37831-6372

We report on measurements of projectile neutralization of slow F, Ne, and Ar multicharged ions 120° backscattered from RbI(100). For this alkali halide crystal, the projectile energy loss difference resulting from large-angle scattering interactions with Rb and I is experimentally resolvable, permitting simultaneous determination of backscattered charge-state distributions from each species. Significant dependences of the scattered projectile charge fractions on azimuth orientation of the RbI(100) target were found, using a time-of flight set-up with floatable drift tube [1]. This dependence is ascribed for the present target to surface quasi-binary double collisions. For such collisions, the first hard collision is followed by a grazing, large impact parameter interaction with a neighboring surface lattice site on the receding part of the scattered projectile trajectory. Such quasi-binary double collisions are experimentally unresolvable from true binary collision events. An azimuth dependence was observed also in the case of negative ion formation from incident F^{q+} projectiles. Since the surface-atom (i.e., Rb or I) with which the second (grazing) interaction occurs could be selected by target azimuth setting, all possible combinations of quasi-binary double surface scattering events: Rb-Rb, Rb-I, I-Rb, and I-I, could be studied and their effectiveness for projectile neutralization assessed.

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[1] V.A. Morozov and F.W. Meyer, Phys. Rev. Lett. **86**, 736 (2001); Rev. Sci. Inst. **70**, 4515 (1999).