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Production of Radioactive Molecular Ions in a Radiofrequency Quadrupole Gas-Reaction Cell

Radioactive molecular ions (RMI) are made in hot-cavity targets of isotope separation on-line (ISOL) facilities like TRIUMF following fission, fragmentation or spallation. However extreme conditions in targets (high temp, bad vacuum, radiation fields, chemical/isobar impurities, energy ranges, uncontrolled reaction kinetics) are formidable unsolved challenges to efficient production and delivery of RMI. Here we use an RFQ gas-reaction cell, the ion reaction cell (IRC), to produce RMI from radioactive ion beams (RIBs) at energies between 10-40 keV by room temp RIB-gas chemical reactions at eV energies. A linear RFQ gas-reaction cell and ion guide used as an "on-line ion source"is a controllable and efficient way to produce RMI from chemical reactants that cannot be used in ISOL targets. We present SIMION simulations of the IRC optics, physics of the IRC and plans to integrate the system at the TRIUMF ISAC facility for radioactive beams, to enable groundbreaking research with molecules.

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