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Creation and Characterisation of Multi-Charged Cerium Beams at the TRIUMF OLIS Facility

We discuss the development of novel lanthanide beams at TRIUMF's Off-Line Ion Sources (OLIS) Facility, focusing here on $^{140}\text{Ce}^{+n}$ for astrophysical research and molecule formation studies between halogens and lanthanides for electron dipole moment measurements. Cerium is the first lanthanide beam created at the OLIS facility by dual frequency electron cyclotron resonance (ECR) using a Supernanogan ion source. Pure cerium was sputtered from a solid metal sample under different gas, bias, and geometric conditions. We discuss the response of the ECR plasma environment on the charge state distribution and current yields. Charge-states up to +21 were observed, and we readily obtained $3e9$ pps of $^{140}\text{Ce}^{+1}$ that was subsequently delivered to TRIUMF's Ion Trap for Atomic and Nuclear Science (TITAN) for molecular formation experiments. Charge state spectra measured by the OLIS mass analyzer and the TITAN MRToF confirmed the purity of the delivered Ce beam in the desired charge states. Cerium expands the portfolio of beams at TRIUMF for basic molecular, nuclear, and astrophysical research. Topics include problems on (1) interstellar medium Ce enrichments from s-process yields of AGB stars, and (2) at TITAN for using Ce as a Th chemical analog for rare radioactive molecule formation and studies on electron electric dipole moments.

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Yes

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