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The role of ECR ion sources in superheavy element synthesis

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Superheavy element (SHE) research focuses on understanding the structure of the heaviest nuclei at the edges of the proposed Island of Stability as well as the synthesis of new elements. Electron Cyclotron Resonance (ECR) ion sources are an important part of this endeavor since superheavy elements (z>104) can be created by bombarding a target with an ion beam that is often produced by an ECR at many facilities. The synthesis of these elements through reactions that have low cross-sections requires intense ion beams of 48Ca, 50Ti, 51V, 54Cr, and 55Mn, for example, in addition to beam delivery for weeks or more. The need for high intensities, coupled with the low isotopic abundance of some of these metals, and thus low availability, requires efficient production methods and careful tuning. These beams are produced by an ECR using various methods that include low temperature ovens, resistively heated high temperature ovens, inductive ovens, sputter probes, and MIVOC. I will summarize the production techniques and the results achieved by ECR ion sources around the world.

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