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Gas-filled and vacuum mode separators for fusion reactions

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Gas-filled and vacuum mode separators have been used for studying the products of fusion-evaporation reactions since the 1960's. Most recently, these separators are being used to study heavy recoils that are produced at rates of atoms per second to atoms per year in complete fusion-evaporation reactions. Due to the low production rates, the present-day separators are highly selective and highly efficient to remove the few wanted heavy recoils from a background of 10^13 beam ions and unwanted reaction products per second.

The next generation of radioactive and high-intensity stable ion beam facilities will pose interesting challenges for gas-filled and vacuum mode separators for fusion-evaporation reactions. At radioactive beam facilities with planned intensities of up to 10^11 ions per second, fusion-evaporation reactions can be used to produce new isotopes of elements up to Z~106 at the rates of atoms per day. However, the beta-gamma decay rate of the beam will be as high as several Curies. For experiments trying to study nuclear properties of low-production heavy elements, highly selective separators will be required for even the 'simplest' of the reactions with radioactive beams.

At high intensity, stable beam facilities, beam intensities of 10^13-14 ions per second would allow for detailed studies of isotopes near the next predicted spherical closed shell. However, and order of magnitude improvement in selectivity over current separators will be required to take full advantage of the higher beam intensities.

An overview of recent developments in gas-filled and vacuum mode separators for fusion reactions, with an outlook toward the next generation of accelerators, will be presented.

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