The ECRIS facility at BARC and its utilization for low energy nuclear reactions and fast neutron production

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A high current Electron Cyclotron Resonance Ion Source (ECRIS) [1] has been installed at the Bhabha Atomic Research Centre, Mumbai. This ECRIS is capable of delivering a wide range of ion beams with typical species including p, d,^{4}He and ^{16}O produced with emA currents. It operates at 30 kV extraction voltage on the 300 kV platform, providing a maximum energy of 330 keV per charge state of the ion. Low energy nuclear reaction experiments and ion-induced atomic physics experiments have already been initiated with this facility at the Centre [2].

In a phased upgradation, it is also planned to augment the ECRIS with a room temperature heavy-ion RFQ (Radio Frequency Quadrupole, 575 keV/u), which is currently under development. This will enhance the capability of the facility for producing multi-energy fast neutrons using low energy exoergic reactions (e.g. d+^{7}Li), for a variety of applications in both basic and applied research [3].

Compact accelerator-driven neutron sources based on low-energy neutron-producing reactions, are being built across the world due to their increasing importance in basic and applied research [4–6]. Experiments performed in these facilities include study of fast neutron induced fission, (n, f), of actinides particularly relevant to GEN-IV reactors and Accelerator Driven Systems (ADS), (n, cp) reactions important for fusion reactor technology, (n, Xn) reactions relevant for radioisotope production and various aspects of nuclear astrophysics and nuclear spectroscopy [4–8]. With the addition of an appropriate RFQ and DTL, the ECRIS could provide deuterium beams in the range of $1-3$ MeV and ^{7}Li beams in the range of $14-21$ MeV at high currents, suitable for the production of fast neutrons of sufficient intensity and time-energy characteristics relevant for the various applications mentioned above [3].

Some of the recently published results from the low energy nuclear reaction experiments carried out at the ECRIS and the layout and details of the schemes for producing multi-energy fast neutrons, will be presented in the talk.

References

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