Preliminary studies of in-cell electrophoresis as Li-6 enrichment technique

M. Fernández, A. I. Barrado, E. Conde, A. Quejido, J. Quiñones, G. Veredas, L. Sedano CIEMAT, Av. Complutense 22 E-28040 Madrid.

Future fusion reactors will use deuterium and tritium as fuel. The former can be obtained in abundance from seawater, while the latter doesn't occur in nature due to his short lifetime (10 year half-life). The most promising source of tritium seems to be its generation in a blanket by neutron bombardment according to the reaction: n + 6Li? T + He. These blankets are thus considered "Breeding Blankets" and, for most systems conceived today, the tritium breeding capability depends, to a great degree, on the ⁶Li enrichment. Ranges of ⁶Li enrichment are ~ 90% for Liquid Breeder concept and in ~ 30-60% for Solid Breeding concept. Needs for future machines can be roughly estimated of 50 tonnes of ⁶Li (case of DEMO 1.5GWe, lithium-lead eutectic alloy Pb15.7Li).

Therefore, the development of a 6Li enrichment technique in terms of technical reliability and scalability to reach future 6Li requirement, represents a key step in the roadmap of Fusion Programmes worldwide.

This paper presents the technique of liquid bath electrophoresis as one of the most promising methods for achieving the necessary enriched lithium production. To carry out the process we have conceived a prototype cell whose design allows the connection in series of several units in order to form a linear cascade. In this study we also present the possible materials for their construction (housing and electrodes) as well as the lithium ion conductors that can be used as electrophoretic membranes.