Feasibility investigation on lithium ortosilicate pebble fabrication by wet method

Abstract

D–T based fusion reactors require both deuterium and tritium as fuel. Since tritium is not naturally available in significant quantities, it must be produced artificially. Lithium is currently the only viable material for breeding tritium in commercial fusion reactors. Among various lithium-based compounds, lithium orthosilicate (Li4SiO4) has been recognized as a promising tritium breeding material for D–T fusion reactor blankets.

Lithium orthosilicate offers a higher lithium density compared to lithium titanate, which enhances tritium production. However, its mechanical properties are inferior to those of lithium titanate. Lithium orthosilicate is intended to be used in the form of spherical pebbles within the reactor blanket. Globally, several methods are under investigation for the fabrication of these pebbles. Promising techniques include melt spraying extrusion–spheroidization, gel casting , powder injection molding, the graphite bed process, and pan granulation. In India, the extrusion–spheroidization method is already being explored

The wet method is considered a suitable alternative, offering advantages such as high production yield, improved sphericity, and better control over porosity.

This project aims to develop lithium ceramic pebbles with diameters less than 2 mm using the wet fabrication method. The focus will be on achieving spherical geometry in both green (unsistered) and sintered states. The student is expected to work on advanced laboratory equipments, including high-energy ball mills, granulation systems, muffle furnaces, and microscopy techniques.

Name of course with branch/discipline: Chemical Engineering / CAPD / Metallurical Engg.

Academic Project Requirements:

1) Required No. of student(s) for academic project: 1

2) Name of course with branch/discipline: M.E./M.Tech Other

3) Academic Project duration:

(a) Total academic project duration: 40 Weeks
(b) Student's presence at IPR for academic project work: 3 Full working Days per week

Email to: aroh@ipr.res.in[Guide's e-mail address] and
project_other@ipr.res.in [Academic Project Coordinator's e-mail address]

Phone Number: 079 -07923962338 [Guide's phone number]