Cost Modeling for Fabrication of IFE Targets*

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Chemical engineering analyses are underway for a commercial-scale (1000 MWe) divinyl-benzene foam-based IFE target supply facility. This facility is designed to supply 500,000 4 mm OD targets per day – coated via interfacial polycondensation, dried with supercritical CO_2, sputter coated with Au and/or Pd, filled with DT, layered at cryogenic temperatures and transferred for injection. Such targets would be used in a direct-drive IFE power plant.

The work uses basic technology methods being developed in the laboratory, chemical engineering scale-up principles and practices, including counter-current, stagewise contacting and established cost estimating methods and factors. Recycle and beneficial reuse of process effluents are being designed into the facility.

The plant conceptual design includes a process flow diagram, mass & energy balances, equipment sizing and sketches, storage tanks and facility views (plan, elevation & perspective).

The cost estimate includes both capital and operating costs. Capital costs are broken down into purchased equipment, engineering/contingency, buildings/auxiliaries and piping/electrical/ instrumentation. Operating costs are broken down into operating staff, chemicals, maintenance, utilities and waste disposal. Sampling and inspection equipment and staffing costs are included at all stages of target preparation. Where appropriate, initial discussions were held with vendors of commercial equipment that may be used in the facility.

Initial results indicate that the costs per target are within the commercially viable range. Sensitivity studies are underway to determine the confidence level in these costs as a function of the variability of individual and combined assumptions. Of particular interest is the rate of target QA/QC rejection at the various phases of preparation.

The chemical engineering modeling techniques are intended to provide guidance on process development needs (and subsequent research directions) and to serve as a standardized method of comparing process costs for future evaluations of foam and various other target types. Front-end costs (for tritium supply) and back-end costs (for target injection and tracking) are being added to the overall model.

A set of independent analyses are also underway for a polymer-based capsule suitable for use in a heavy-ion driven hohlraum target.

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