

# Overview of hydrodynamics and scale-up of TRISO spouted beds coaters

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The quality of TRISO coated nuclear fuel particles is crucial to the successful operation and safety of Very-High-Temperature Nuclear Reactors (VHTR). For this reason, the TRISO particles should be free of defects and uniform in size and shape, as well as have a uniform coating. In this respect, the gas-solid spouted bed coating technology of TRISO particles is important. Coating layers around the fuel kernel are delicate processes impacted mainly by the hydrodynamics of the spouted beds. It becomes even more complex when considering that the success of the preceding coating affects the probability of coating the next layer successfully. As the current spouted bed coaters are relatively small, large-scale spouted beds are also essential to fabricate high-quality and large quantities of TRISO particles for the VHTRs. It is imperative to develop large-scale spouted beds in order to meet the growing demand for TRISO particles for the VHTRs. Thus, the scaling up of spouted beds is considered one of the major challenges in manufacturing TRISO nuclear fuel particles. Although the insights provided by the literature on spouted beds, scale-up of gas-solid spouted beds is still far from satisfactory. Correspondingly, having a fundamental understanding of hydrodynamics and scale-up of spouted beds dynamics is essential towards the development and commercialization of the VHTRs. In this work, a comprehensive overview of our newly developed and validated mechanistic scale-up methodology for gas-solids spouted beds based on matching the radial profile of gas holdup is presented. The overview aims at pointing out the present findings and challenges about the mechanistic scale-up methodology of gas-solids spouted beds. In addition, the overview includes a comparison between this mechanistic scale-up methodology and traditional scale-up methodology based on matching dimensionless groups to demonstrate its improved accuracy in predicting the performance of spouted bed systems.

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