



Contribution ID: 23

Type: Oral

Experimental Study of Pebble Flow Dynamics in a PBMR Using RPT

Tuesday, 25 April 2017 17:45 (15 minutes)

The pebble bed modular reactor (PBMR) is a type of 4th generation nuclear reactor. In a pebble bed reactor, nuclear fuel is in the form of spherical pebble and moves slowly inside the core of the reactor under the influence of gravity. A coolant gas moves through the voids formed in between the pebbles and removes fission heat generated from the nuclear fuel. Multiphase Reactors and Applications Laboratory (mREAL) at Missouri S&T has designed, developed, and tested a scaled down continuous pebble re-circulation experimental set-up, mimicking the flow of pebbles in a PBMR. An experimental study of pebble flow dynamics in a cold flow setup was carried out using a radioactive particle tracking (RPT) technique that used a cobalt-60 based tracer to mimic pebbles regarding shape, size, and density in a non-invasive way. The RPT technique is capable of providing a full description of the 3-D flow field in highly dense and opaque reactors. Obtained results of the Radioactive Particle Tracking technique regarding Lagrangian trajectories, residence time distributions, velocity field, etc. are a valuable benchmark data for an assessment of the contact force model used in the Discrete Element Method (DEM) based simulations.

Country/Organization invited to participate

United States of America

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Session Classification: B07

Track Classification: RADIATION TECHNOLOGIES FOR MEASUREMENT