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Fabrication of Hollow Germanium Spheres by Dropping Method

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Abstract : Hollow germanium alloy quasi-spheres of diameters 1 to 2 mm with a relatively smooth inner and outer surface have been produced. The germanium was first melted at around 1273 K and then exuded from a coaxial nozzle into an inert atmosphere by argon gas supplied to the inner nozzle. The falling spheres were cooled by water spray and collected in a bucket. The spheres had a horn type of structure on the outer surface, which might be caused by volume expansion induced by the density difference between solid and gas phase. The frequency of the sphere formation was determined from the videos to be about 133 Hz. The outer diameter varied in the range of 1.3 to 1.8 mm with a wall thickness in the range of 0.2 to 0.5 mm. Solid silicon spheres are used for spherical silicon solar cells (S_3CS), which have various attractive features. Hollow S_3CS promise substantially higher energy conversion efficiency if their wall thickness can be kept to 0.1–0.2 mm and the inner surface can be passivated. Our production of hollow germanium spheres is a significant step towards the production of hollow S_3CS with, we hope, higher efficiency and lower material cost than solid S_3CS.

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