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Solidification and the Effects of Internal Heat Generation JOHN CREPEAU, University of Idaho, ALI SIAHPUSH, Idaho National Laboratory — Solutions using the integral method are presented for solid-liquid phase change in materials that generate internal heat. This problem is solved for cylindrical, spherical, plane wall and semi-infinite slab geometries. The analysis assumes a temperature profile in the solid phase and constant temperature boundary conditions on the exposed surfaces. We derive differential equations governing the solidification thickness for the geometries as functions of the Stefan number and the internal heat generation (IHG). For cylindrical, spherical, and plane wall geometries, the solidification layer obtains a steady-state value which is related to the inverse of the square root of the IHG. The solutions to the semi-infinite slab geometry problem show that when the surface is cooled to below the freezing point, a solidification layer forms along the edge and begins to grow until it reaches a maximum, then begins remelt. The problem has application to diverse fields such as nuclear energy, materials processing, geophysical fluids, and bioengineering.

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