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Investigation of the Inverse Leidenfrost Effect in the Production of Moderating Material for Cold Neutron Sources

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The dispersed moderating agent for cryogenic moderators of the IBR-2M reactor is produced by the formation of droplets and subsequent freezing in liquid nitrogen. The heat exchange between the droplet and liquid nitrogen leads to intensive local boiling of the liquid nitrogen, resulting in vapor cushioning and heat exchange. This phenomenon is known as the Leidenfrost inverse effect.

The device that utilizes this effect consists of a cryostat and a dropper. The cryostat, a vertical vessel, is filled with liquid nitrogen and is isolated from the bottom and sides of the outer space by a vacuum jacket.Inside the cryostat, cells ensure the freezing of each drop in a separate volume.During the manufacturing process, beads accumulate at the bottom of the cryostat.

The utilization of a “steam cushion” approach enables analytical calculations to determine the duration of ball formation under specific conditions. These conditions include the quasi-static nature of the process, the spherical shape of the drop, and the uniformity of the crystallization process.While this analysis provides a fundamental understanding of the processes involved, it serves as a solid foundation for further research and the practical application of the obtained knowledge.

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