Research on Solidifying Liquid Drops

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When a drop of water is dripped on a cooled metal plate, it solidifies into the shape with the cusp-like top. The frozen drop has an inflexion point near the cusp. As an example, this effect can be observed on a car hood, during sleet. The main goal of the research consists of investigation and explanation of the effect. Other liquids, solidifying under similar conditions, were examined. Freezing proceeded at -15, -24, -78, -196 degrees Celsius. The investigation included digital photo analysis. Real drops were compared to the predicted theoretical model, which is precisely computer simulated geometrical shape of the frozen drop. Assuming, that the effect appears only for liquids, which expand in volume during freezing, cusp formation is supposed to be caused by both surface tension and pressure on the liquid of the solidifying melt. The theoretical model is based on this hypothesis. It has been found out, that the effect takes place for water and for liquid gallium metal. Empirical results have shown that the final shape of a frozen drop doesn’t depend on the temperature of the cold plate, therefore the shape of the solidified drop doesn’t depend on the solidification rate. As a result, theoretical model has been verified.

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