

# Predicting improved cooling speed of metals coated with low conductive materials in liquid nitrogen

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**Abstract.** It is a well-known phenomenon that low conductive coatings on a metal decrease the overall cooling time of a metal when quenched in liquid nitrogen. The early transition to nucleate boiling regime from the film regime is discussed in the literature as the main cause of this enhanced cooling rate. However, till now optimization of the coating thickness to minimize the cooling time has only been an empirical proposition. In this paper, a phenomenological model is proposed that combines the coating properties, thickness and fluid properties. This model is validated with cooling experiments performed with various specimens in both saturated and sub-cooled liquid nitrogen. A good agreement of the model with the experimental data is found.