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Dynamics of liquid nitrogen cooling process of solid surface at wetting contact surface.

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Liquid cryogenics cooling by direct contact with cooled surface is very often used as a method to drop the temperature of the devices or equipment i.e. HTS cables. Somehow, the cool-down process conducted in that way could not be optimized, because of cryogen pool boiling characteristics and low heat transfer coefficient. One of the possibilities to increase the efficiency of heat transfer, as well as the efficiency of cooling itself, is to use the spray cooling method. The paper shows a dynamics analysis of the liquid nitrogen cooling of a solid surface process. The model of heat transfer for a single drop of liquid nitrogen, which impacts a flat and smooth surface with respect to different Weber numbers, is shown. The temperature profiles in the solid are presented, as well as the required cooling time of the solid. Numerical calculations are performed for different initial and boundary conditions such as: droplet size, initial velocity, temperature of surface etc., to study how the wetting contact surface changes, and how it contributes to heat transfer between the solid and liquid cryogen.

Primary author: Mr SMAKULSKI, Przemyslaw (Wroclaw University of Technology)

Co-author: Dr PIETROWICZ, Slawomir (Wroclaw University of Technology)

Presenter: Mr SMAKULSKI, Przemyslaw (Wroclaw University of Technology)

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