



DOCTORAL RESEARCH TOPIC:

Studies on reducing friction resistance under boiling crisis conditions

RESEARCH FIELD:

Energetics and Power Engineering (T 006)

BRIEF DESCRIPTION OF RESEARCH TOPIC:

The Leidenfrost effect was called after the scientist Johann Gottlob Leidenfrost in 1756. The effect occurs when the surface dries out and covers in steam layer (film). For many decades scientists had tried to predict the minimal critical temperature or the critical heat flux limits, which had to be not surpassed as the dry out (or the Leidenfrost effect) of the heat transfer surface was considered as an undesirable effect, with potential impact on the conditions for the prevalence of accidents. Earlier researchers mainly studied the processes that occur on heat transfer surfaces and liquid before the prevalence of critical heat flux. Boiling crisis – an extremely important factor, which occurs in nuclear reactors during the cooling process. It is important, because without having a sufficient knowledge on how to act in such critical situation (second level boiling crisis), the consequences can be detrimental. After studying the processes that happen during the boiling crisis (the change in friction between the body and steam film, effect of rapidly changing environment's temperature on the cooling body and others), it would be easy to manage the critical situation and know how to act if these limits are exceeded. Another alternative for the application of second degree boiling crisis would be: reduction of friction for the body which moves in the water. With this study would be reached to determine the most favorable conditions for the formation of the Leidenfrost effect, taking into account the characteristics of the surface coating of the sample by applying various measures. It is known that the properties of the surface coating influence the formation of a vapor film (bubble), therefore, one of the possibilities to create favorable vapor formation conditions is the application of coatings to the surface. However, the variety of coatings and the specific physical properties of the materials (conductivity, density, roughness, porosity, microstructure, hydrophobicity) when interacting with the liquid can influence the formation of steam in the wide temperature range. In addition, the application of innovative methods in energy is important, and therefore the novelty of work is best associated with the influence of chemical reactions between the sample surface and the liquid generating additional gas for ensuring the stability the film of vapor. One of the phenomena is the reaction of aluminum with water when hydrogen gas is released. There are other substances that react with water in the same way as magnesium, sodium, etc. Such a method has not been investigated, therefore, the application of coatings to obtain the efficiency of the Leidenfrost phenomenon is not easy task.

Expected results – the study of the physicochemical properties of coatings for the formation of Leidenfrost would be reducing the body's resistance.

Object of research – the conditions for the formation of the Leidenfrost effect to reduce the resistance of a body exposed to fluid flow. Aim of research – to investigate the established conditions and the possibilities of the reduction of the spherical body resistance in the liquid applying Leidenfrost effect.

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