Hydroluminescence, cavitation and fatigue resistance of gas turbine materials

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The effects of hydroluminescence and cavitation under intensive liquid flow are studied as mechanisms of the fatigue erosion of gas turbine aviation materials. Experimental setup was developed that allowed recording of hydro- and sonoluminescence signals in the channel using photodetector high resolution system and following data processing. It was found existence of threshold regime corresponding to avalanche luminescence increase for critical strain rates at near-surface layer [1]. This effect was associated with qualitative changes in mechanisms of momentum transfer in liquid: from momentum diffusion to quasi-plastic flow providing topology of "heat points". Temporal sequence of heat points dynamics was analyzed in terms of time-intervals between hydroluminescence sequences to establish scaling universality at critical strain rates. Qualitative changes were found in the transition area to diffuser channel with sonoluminescence signals as the precursor of cavitation phenomena and pulse fatigue loads of materials in combustion chamber.

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[1] Naimark O B, Uvarov S V, Bannikova I A, Efremov D V, Bayandin Y V and Dezhkunov N V 2023 *Lett. Mater.* **13** 93–97