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Numerical and Experimental Study of Heat Transfer Enhancement with Metal Foams and Ultrasounds

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Abstract : The aim of this experimental and numerical study is to analyze the effects of acoustic streaming generated by 40 kHz ultrasonic waves on heat transfer in forced convection, with and without 40 PPI aluminum metal foam. Preliminary dynamic and thermal studies were done with COMSOL Multiphase, to see heat transfer enhancement degree by inserting a 40PPI metal foam (10 × 2 × 3 cm) on a heat sink, after having determined experimentally its permeability and Forchheimer's coefficient. The results obtained numerically are in accordance with those obtained experimentally, with an enhancement factor of 205% for a velocity of 0.4 m/s compared to an empty channel. The influence of 40 kHz ultrasound on heat transfer was also tested with and without metallic foam. Results show a remarkable increase in Nusselt number in an empty channel with an enhancement factor of 37,5%, while no influence of ultrasound on heat transfer in metal foam presence.

Keywords : acoustic streaming, enhancing heat transfer, laminar flow, metal foam, ultrasound
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