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High pressure micro glow discharge: Detailed approach to gas temperature modeling[1] MOSTAFA MOBLI, TANVIR FAROUK, Department of Mechanical Engineering, University of South Carolina — High pressure micro plasma discharge has been the center of interest in recent years, unlike low pressure discharges; gas heating is an important factor in these discharges. A Dirichlet temperature boundary condition (iso-thermal) which is the most commonly used, is unable to capture the cathode and anode wall temperature temporal changes, effects of materials thermal characteristics and also forces an artificial cooling of the discharge. To overcome this inadequacy a conjugate heat transfer (CHT) model has been implemented which is found to resolve the gas temperature predictions both in the volume and the electrode surfaces more accurately. The implemented CHT model increases the overall computational overhead due to resolution of the temperature field in the solid phase, hence a novel temperature boundary condition has been proposed that resolves a temporally evolving electrode surface temperature without implicitly solving the temperature in the solid phase. Comparison with the experimental results shows that these two new approaches are able to predict an agreeable gas temperature distribution. The effect of pressure on the discharge characteristics also has been studied.

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