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Two-temperature modeling of a magnetically rotating arc MARGARITA BAEVA, DETLEF LOFFHAGEN, DIRK UHRLANDT, INP Greifswald, Felix-Hausdorff-Str. 2, 17489 Greifswald, Germany — A three-dimensional, two-temperature MHD model of a DC plasma torch has been developed to study the behavior of a magnetically rotating arc in argon at atmospheric pressure. The torch consists of a 10 mm long rod-type cathode with a diameter of 3 mm surrounded by a 25 mm long hollow anode with a diameter of 10 mm. The arc is supplied by a current of 200 A. Without external axial magnetic field a heavy particle temperature T_h of about 14000 K and 8000 K is obtained near the cathode tip and downstream in the plume, respectively. Significant temperature differences between the electron temperature T_e and T_h up to a factor of 1.4 are found in the arc fringes. When applying an external axial magnetic field of 0.04 T, the high temperature plasma inside the torch is retracted axially and expanded radially. It is involved in rotation due to the Lorentz force and a backflow appears in front of the cathode close to the axis. The inflow and backflow gases impinge onto the anode. T_e and T_h are about 18000 and 13500 K, respectively, at maximum. The T_e profile gets broader than that of T_h. Both profiles are prolonged towards the anode. A similar behavior is observed for the arc power density and the electron density distribution.

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