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Viscous and Induced Current Heating in Plasma Focus Plasmoids AHMAD TALAEI, Research Assistant, ERIC LERNER, Chief Scientist, LAWRENCEVILLE PLASMA PHYSICS, INC. TEAM — Recently, Abolhasani et al, proposed that the high ion energies observed in plasmoids formed in the plasma focus could be explained by viscous heating. We here elaborate this proposal, demonstrating that during plasmoid formation, ion motion along magnetic field lines can be rapidly converted, at least in part, to thermal energy through viscous diffusion. This effect is strongly enhanced by higher-z ions. We compare the theoretical predictions with the recent observation by Lerner et al, of trapped ion energies of 160 keV. In addition, we propose a second source of heating. The mildly relativistic electron beam emitted by the plasmoid, generates an induced current within the plasmoid comparable to the beam current and confined to approximately the same region. The induced current electrons, with drift velocity $v_{de} << v_b$ of the beam electrons, are thus far more effective than the beam itself in Ohmically heating the plasmoid. We show that both these mechanisms are capable of generating ion energies of tens to hundreds of keV for a wide variety of plasmoid conditions. Finally we briefly consider a third possible heating mechanism, through ion-acoustic waves generated by the strongly sheared current and plasma flows in and near the emitted electron beam.

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