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Kinetic features of magnetic reconnection in a plasmoid chain

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The kinetic features of plasmoid chain formation and evolution are investigated by two dimensional Particle-in-Cell simulations. Magnetic reconnection is initiated in multiple X points by the tearing instability. Plasmoids form and grow in size by continuously coalescing. Each chain plasmoid exhibits a strong out-of plane core magnetic field and an out-of-plane electron current that drives the coalescing process. The disappearance of the X points in the coalescence process are due to anti-reconnection, a magnetic reconnection where the plasma inflow and outflow are reversed with respect to the original reconnection flow pattern. Anti-reconnection is characterized by the Hall magnetic field quadrupole signature. Intense electric fields develop mainly in-plane normally to the separatrices and drive the ion dynamics in the plasmoids. Several bipolar electric field structures are localized along the separatrices. The analysis of the electron distribution function and phase space reveals the presence of counter-streaming electron beams and phase space electron holes along the reconnection separatrices.