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On the Similarities of High Pressure Microdischarges YANGYANG FU, BOCONG ZHENG, JANEZ KREK, DEQI WEN, PENG ZHANG, JOHN P. VERBONCOEUR, Michigan State Univ — Similarity and scaling laws are useful tools for understanding plasma characteristics when two or more discharge systems are compared. The similarity laws were previously validated and applied for low pressure discharges while they are disregarded due to the presence of three-body collisions at high pressures. In this study, similarity relations for high pressure microdischarges are investigated based on the voltage-current characteristics using a two-dimensional fluid model. Voltage-current characteristics of the microdischarge, including Townsend discharge, subnormal glow, normal glow, and abnormal glow discharges, are observed. The breakdowns of the microdischarge in the Townsend regime correspond to the right branch of the Paschen's curve and the breakdown scaling laws are found to be still valid even though the three-body conversions are considered. The similarity relations for the electron and ion densities in the high pressure microdischarges are also examined.

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