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Instability of a Short Anodic Arc Used for Synthesis of Nanomaterials[1] SOPHIA GERSHMAN, YEVGENY RAITSES, Princeton Plasma Physics Laboratory — The short anodic arc discharge is used for the synthesis of nanomaterials and had been presumed stable. We report the results of electrical and fast imaging measurements that reveal a combined motion of the arc column and the arc attachment region to the anode when the arc is operated with a high ablation rate. The arc exhibits a negative differential resistance before the arc motion occurs. The observed arc motion correlates with the arc voltage and current oscillations. The characteristic time of these instabilities is in a 10^{-3} sec range. Thermal processes in the arc plasma region interacting with the ablating anode are considered as possible causes of this unstable arc behavior. The measured negative differential resistance of the arc during the oscillations indirectly supports the thermal model. Our model suggests that the injection of the ablating material into the plasma locally reduces the energy flux to the surface and leads to the arc shifting to the adjacent position. The observed arc motion can potentially cause the mixing of the various nanoparticles synthesized in the arc in the high ablation regime leading to the poor selectivity characteristic of the arc synthesis of nanomaterials.

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