Impact of arcing ablation to the carbon matrix composites and optimization methods

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In electrified railway, the sliding electric contact, between the pantograph strip with the contact line, plays the key role of supplying electrical power to the vehicle. Carbon or graphite matrix composites, with good strength, self-lubrication, and electrical conductivity, are used to make the pantograph strip.

However, the inevitable arcing discharge during the sliding electrical contact, resulting in serious thermal impact and ablation to the electrodes, has been a major problem for the reliable transmission of energy. Especially, with the increased train speed, both the power capacity and the mechanical impacts are becoming far more challenging. The complex pantograph arcing throws much threat for the carbon strip, and better composite with improved conductivity and mechanical strength are needed[1-3].

In this work, we have conducted both experimental test and numerical study on impact of arcing ablation into the carbon matrix. Arcing dynamics between pairs of copper alloys and carbon composites are studied using the high-speed imaging, OES, Schlieren photography, and microscopic analysis, etc. MHD based simulation is carried out to further investigate the influences of different environment parameters. Methods to improve the composites performance are proposed through careful design to improve the inner interface bonding of composites.

References

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Note: Abstract should be in (full) double-columned one page.

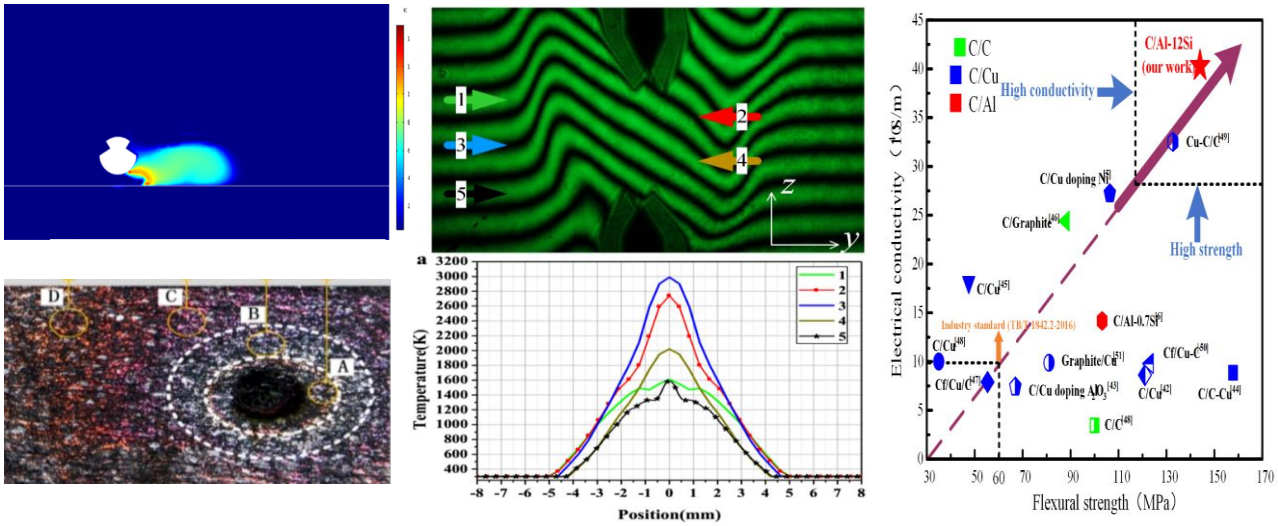

FIG1. Typical pantograph arcing dynamics and induced materials ablation (left), the spatial temperature distribution (middle), and improved material properties with interface enhancement (right).