C/C Composite Material for Pantograph's Contact Strips

Outline:
It is known that the use of carbon materials in pantograph's contact strips is an effective way of reducing wear of contact wire. However, the carbon materials have not been used widely in Japan because of their low mechanical strength and poor electrical conductivity. In the last decade, carbon fiber reinforced carbon composite (C/C composite) into which copper alloy is impregnated has been developed. The C/C composite has been tested and confirmed to be applicable to contact strips, and has been applied to the electric vehicles of several private railway companies.

Effects:
The C/C composite has higher mechanical strength than conventional metal impregnated carbon materials. Besides the sufficient mechanical strength, the C/C composite also has the advantage of easy fitting to pantograph head. Since the C/C composite consists of a textile structure of carbon fiber with higher strength and toughness, it is as easy to cut a female screw in it as in an alloy. When the C/C composite is mounted on a pantograph head directly by screw bolts, the pantograph head weighs approximately 15% less than mounted with steel sheath.

Table: Weight comparison of a pantograph head and its constituent parts

<table>
<thead>
<tr>
<th>Mounting method</th>
<th>Main strips (kg)</th>
<th>Auxiliary strips (kg)</th>
<th>Pantograph head (kg)</th>
<th>Total weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel sheath (currently used)</td>
<td>3.0</td>
<td>0.7</td>
<td>2.1</td>
<td>5.8</td>
</tr>
<tr>
<td>Screw bolts</td>
<td>2.0</td>
<td>1.2</td>
<td>1.8</td>
<td>5.0</td>
</tr>
</tbody>
</table>

The C/C composite material and its mounting method were developed under a joint R&D contract with Fine Sinter Co., Ltd. and Across Co., Ltd.
Appearance of C/C Composite Contact Strip Material

C/C Composite Contact Strips Attached on Actual Pantograph Using Screw Bolts

Layered Structure of Carbon Fiber Fabrics