

C-SOLDER TYPE: SAC-1B



I. FEATURES OF TECHNOLOGY

The unique properties of graphitic materials, including low density, high melting temperature, excellent thermal conductivity, resistivity to corrosion and erosion as well as great mechanical performance in wide range of temperatures might render them unrivalled candidates for the applications in many areas of industry. However, the difficulty of joining of these structures together or to other materials such as metals has always been one of the major constraints limiting the application of classic carbon materials and nowadays becomes an obstacle for the potential use of nanostructured carbon materials.

Up to now it has not been possible to apply soldering to graphitic materials as they are not wetted by the commercially available alloys.

C-SOLDER is a trade name for a group of new tin-based lead-free low-temperature soldering alloys which enable joining of various carbon materials including carbon fibres or carbon nanotube fibres in both carbon-carbon and carbon-metal arrangements.

The use of these alloys allows fast formation of mechanically strong bonds which are electrically conductive simultaneously.

Table 1

Main features & benefits of brazing, adhesive joining, mechanical fastening and soldering of carbon materials

Feature	BRAZING	ADHESIVE JOINING	MECHANICAL FASTENING	SOLDERING (C-Solder)
Time to make the joint	FEW STEPS, MIN. TO HRS.	FEW STEPS, LONG CURE	SEVERAL STEEPS, RAPID ASSEMBLY	ONE OR TWO STEPS, SEVERAL SEC.
Surface preparation	MINIMAL	EXTENSIVE	MINIMAL	MINIMAL
Thin sections	YES	YES	NO	YES
Joint weight	LIGHT	LIGHT	HEAVY	LIGHT
Stress concentrations	HIGH THERMAL STRESSES	CAN BE VERY LOW	SIGNIFICANT	CAN BE VERY LOW
Sensitivity to peel forces	SUSCEPTIBLE	SUSCEPTIBLE	RESISTANT	SUSCEPTIBLE
Sensitivity to tensile forces	RESISTANT	RESISTANT	SUSCEPTIBLE	RESISTANT
Applied in-situ	NO	YES	YES	YES
Suitability for CNT and graphene	NO	YES	NO	YES
Electrical & thermal conduction	YES	NO	NO	YES

II. FEATURES OF THE PRODUCT

The strong bond between metals and non-metals requires the proper design of the composition of soldering alloy. C-SOLDER tin-based lead-free low-temperature soldering alloys enable joining of various carbon materials including carbon fibres or carbon nanotube fibres in both carbon-carbon and carbon-metal arrangements.

The soldering of carbon materials, using C-Solder Type: SAC-1B, may be performed in air, at temperatures in the range from 300°C to 450°C with the use of classic soldering iron. High temperature, typical for the brazing process (800-1200°C), may lead to the combustion of carbon materials, in particular nanostructured ones, as well as is responsible for the stress concentration during cooling of the joint made of materials with considerable difference of thermal expansion coefficients.

C-SOLDER Type: SAC-1B:

- **Excellent wetting of carbon materials: graphite, carbon fibres, carbon nanotube fibres, graphene, etc.**
- **Suitability for bonding in carbon-carbon and carbon-metal systems.**
- **Soldering temperatures below 450°C.**
- **Good mechanical and electrical properties.**
- **Lead free.**
- **Flux free.**

Thanks to the unique patented chemical composition C-SOLDER alloys allows to control the course of the surface processes and thus influence on the wetting angle and work of adhesion.

Furthermore, C-SOLDER alloys exhibit improved electrical and mechanical properties in relation to commercially available alloys.

III. Safety and Handling

For safe handling information on this product, consult the Material Safety Data Sheet, (MSDS).

IV. Note

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