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## Coating Graphite Hints

### PREPARATION OF GRAPHITE SURFACES FOR PAINTABLE COATINGS

Graphite crucibles/components after machining generally have a lot of surface dust and dust in the pores. Ideally, to prevent or reduce reaction with this dust, it should be reduced or removed before applying a paintable coating. This can be done by using an ultrasonic cleaner – putting the graphite into water or a solvent and ultrasonically cleaning the part, then removing the liquid (generally quite blackened from the dust) and replacing with fresh/clean liquid and repeating this until the surrounding liquid is minimally blackened after sonication. Most folks will not go to this much trouble before applying a paintable coating.

The next best way to clean the graphite of the dust is to just clean the pieces with solvent (ethyl alcohol or acetone) by rubbing a solvent-soaked cloth or paper towel onto the graphite for several times, until the paper towels or cloths are not overly 'blackened' from the wiping. Generally, four or five wipings in will remove most of the machine dust on the parts.

After cleaning the graphite parts, then, IF BRUSHING, use a 'bristle brush" and apply one coating over the part uniformly, and let that dry. The first coating (even after cleaning) may still be grayed somewhat due to graphite pickup from the wet coating. Then a second coating is applied over that one. Since these are water-based coatings, the second coating needs to be applied FAST if done at room temperature by brushing. OR, alternatively and ideally, both brush-applied coatings should be applied to the surface preheated to around 40 C: this will give better coatings and prevent 'bleed-through' of the gray layer into the topmost coating.

Using the above two-coating scheme, pre-cleaning the graphite may not be necessary ... since the first coating entraps the graphite dust. The second coating, applied after drying the first coating, is typically not much grayed from the graphite dust and thus presents a rather pristine surface for the desired processing. While lab-applied brushed coatings are typically less than 0.008 inch (or 8 mils or 0.2 mm) thickness after drying, production-applied brushed coatings can go to 0.010 inch (10 mils or 0.25 mm) or more after drying. However, keep in mind that thinner coatings perform better, with less tendency to flake off during thermal cycling or during the process.

Air-spraying with pressure-fed spray-guns can be done onto graphite parts that are not cleaned of surface dust and will typically give more uniform coatings than brush-applied coatings. However, when coating over surface dust, it is like coating onto a freshly sawed piece of lumber with sawdust on the surface: you are coating the sawdust and not the underlying surface, so the adherence is reduced quite a bit. Also, when surface dust on graphite parts is mixed with the paintable coating during application, the graphite easily is in a position to react with oxides to form carbides – which often happens when the system is in vacuum at high temperatures (generally above 1200 C). This reaction is typical ...



The vacuum pulls off the CO and drives the reaction to the right, whereas at atmospheric pressure of inert gas (Ar, He) the reaction may not occur even at much higher temperatures since the CO is not pulled off.