

Why is the ITC-213 Coating Flaking Off of My Pipe Crucible?

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If you have coated your pipe crucible and are seeing the coating flaking off, this paper may help you to understand and solve the problem.

One or more the following can cause the flaking:

1. Failure of the 213 to bond to the underlying metal.
2. Failure of the underlying metal itself.
3. Failure within the ITC-213 layer, and
4. Mechanical damage.

1: Failure to Bond

In the first case the 213 has not bonded to the metal. Two things, surface contamination and lack of mechanical bonding area typically cause this. The metal surface must be completely clean and free of all traces of residual manufacturing oils. The slightest oil residue, possibly even from fingerprints, can prevent this water-based material from adhering properly. This is the reason that the manufacturer recommends the Clorox rinse prior to application. (In my opinion it wouldn't hurt to first coarse sand the metal, degrease it with paint thinner, wash with detergent and water, rinse with hot water, and then do the Clorox rinse.)

The other cause, lack of mechanical bonding area, is usually only a problem on surfaces that are very smooth, ground, or polished. This is another reason for roughing up the surface prior to application.

2: Failure of Underlying Metal

The second case is failure of the underlying metal itself. If the pipe was previously fired it may have a deep, oxidized scale layer. This scale layer will eventually mechanically fail to adhere to the metal layer beneath it, and will spall off taking the ITC-213 with it. Once again a good mechanical cleaning is necessary to remove weak material.

3: Failure of the Coating Layer

The third case is a failure within the ITC-213 layer. This can occur if too thick layer of the material is applied. Here the shear stresses within the coating can cause delamination within the ceramic layer and flaking off of the coating. It's important to get a thin, even coating applied. Forcefully rubbing on the material with a cloth, clean brush or painting pad will help to promote good adhesion and evenly coat the surface. Be careful of buildup in areas where surfaces meet, such as at the bottom of the crucible.

4: Mechanical Damage

Mechanical damage can occur if the coating is impacted enough to deform the underlying metal. Scrapes are generally not a problem, but dents can be. It may be helpful to overcoat the ITC-213 with ITC-296A Ceramic Top Coating to protect the 213 layer.

Unfortunately it's often difficult to distinguish what is really happening. Failure to bond and failure of the underlying metal surface can look much the same without the aid of a microscope to examine the failure site or a flake of the spalled material.

Perhaps the most practical way to deal with flaking problems is to recoat the surface after carefully preparing the affected areas. Then slowly heat the empty crucible to operating temperature and allow it to slow cool back to room temperature and examine the recoated areas. With any amount of luck this will have solved the problem.