

BINDER FOR BINDING BRAZE ALLOY AND OTHER METALLIC
PARTICLES IN JOINING AND REPAIR OF JET ENGINE COMPONENTS

BACKGROUND OF THE INVENTION

This invention relates to a binder for braze alloys and other metallic particles for use in jet engine component repair and joining applications.

Binders are used in connection with metallic braze alloy powders to form viscous slurries which are applied to damaged jet engine components during repair operations. Such slurries are also used in conventional brazing joining operations. Such binders often contain agents such as acetone, 111' trichloroethane, and toluene.

These agents are selected because they form a flowable, workable slurry with metal powders, because they burn off at braze temperatures, and because they do not have intolerable negative effects on the braze alloy structure and properties. However, these and similar agents have certain disadvantages, in particular, they are volatile and present potential disposal difficulties and health hazards if not handled according to established guidelines. Furthermore, they typically have an unpleasant, objectionable, and even noxious odor. There is a need, therefore, for binders which are water soluble, have burn-off properties which are equal to or better than current binders, have no detrimental effects on braze alloy structure and properties, and are odorless.

SUMMARY OF THE INVENTION

Briefly, therefore, the invention is directed to a binder for binding braze alloy particles in jet engine

component brazing operations, the binder comprising from about 60% by weight to about 90% by weight water and from about 10% by weight to about 40% by weight polyethylene oxide.

The invention is also directed to a binder for binding braze alloy particles in jet engine component brazing operations, the binder being solvent-free and comprising from about 60% by weight to about 90% by weight water and from about 10% by weight to about 40% by weight polyethylene oxide.

DETAILED DESCRIPTION OF THE INVENTION

The binder according to this invention employs polyethylene oxide (PEO), which is a fine, water-soluble, white powder having a chemical formula of $(-\text{CH}_2\text{CH}_2\text{O}-)_n$. PEO is available from, for example, Aldrich Chemical Company of Milwaukee, Wisconsin. The preferred PEO is 100 to 100,000 molecular weight. When PEO is mixed with deionized water, the resulting mixture is a viscous fluid. This fluid serves as a binder which is then mixed with superalloy powder or other metallic powder to form a slurry.

The binder contains from about 10% to about 40% by weight PEO and from about 60% to about 90% by weight water. In one particularly preferred embodiment, the PEO constitutes about 20% by weight, and the water constitutes about 80% by weight. In forming the binder, these components are weighed out, and the water is added to the PEO, or the PEO is added to the water. The water is preferably moderately heated to a temperature of about 150°F (65°C) before adding the PEO. These two components are then

mixed thoroughly using a spatula or other mixing device such as a variable speed electric blender. Mixing is continued until the mixture becomes a viscous fluid constituting a binder, with no evidence of PEO powder clumps in the mixture. Mixing time is typically less than about 10 minutes.

After mixing the binder is allowed to cool, preferably for about 2 hours, and then to settle, preferably for at least about 24 hours, prior to use. It is important that the binder be cool and free of air bubbles prior to use.

The binder is then added to a superalloy powder or other metallic powder to form a slurry. The ratio of binder to metallic powder is dictated by the particular function of the resulting slurry.

In an alternative preferred embodiment of the invention, xanthan gum is added to the water/PEO mixture. It has been discovered that xanthan gum additions increase shelf life by decreasing the tendency for separation between PEO and water. Xanthan gum is preferably added in an amount of from 0.1% to about 5% by weight of the total binder. In one particularly preferred embodiment, the xanthan gum constitutes from about 0.2% to about 0.3% by weight, more preferably about 0.25% by weight, water constitutes about 79.75% by weight, and PEO constitutes the remaining about 20% by weight. Xanthan gum is available from, for example, the Nutrasweet Kelco Company of San Diego, California. Mixing is carried out as described above, with the xanthan gum added to the water simultaneously with or after the PEO.

The binder of the invention has the advantage that it is solvent-free, defined herein as containing essentially no organic solvents such as acetone, 111' trichloroethane, and toluene. The binder has the advantages that it is environmentally safe, that it contains no harmful solvents, that it is water-based rather than solvent-based, that it is easy to clean up when spilled, that it is odorless, that it has a longer shelf life than previous binders, that both PEO and xanthan gum raw materials are in easy-to-handle powder form, that it exhibits burn-off properties roughly equal to or better than previous binders, that its raw materials are abundant and relatively inexpensive, and that it is useful for conventional brazing joining applications as well as repair. A further advantage is that it exhibits loading capabilities which are roughly equal to or better than the capabilities of current binders, which reduces the risk of voiding in braze repairs. This corresponds to decreased porosity in the braze, decreased rates of rejection, and increased process yields.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

WHAT IS CLAIMED IS:

1. A binder for binding braze alloy particles in jet engine component brazing operations, the binder comprising from about 60% by weight to about 90% by weight water and from about 10% by weight to about 40% by weight polyethylene oxide.
2. The binder of claim 1 further comprising xanthan gum.
3. The binder of claim 2 comprising from about 0.1% by weight to about 5% by weight xanthan gum.
4. The binder of claim 3 comprising about 0.25% by weight xanthan gum.
5. The binder of any one of the preceding claims comprising about 20% by weight polyethylene oxide and about 80% by weight water.
6. The binder of any one of the preceding claims wherein the binder is solvent-free.
7. The binder of any one of the preceding claims wherein the polyethylene oxide is from about 100 to 100,000 molecular weight polyethylene oxide.
8. A binder for binding braze alloy particles in jet engine component brazing operations, the binder being solvent-free and comprising from about 60% by weight to about 90% by weight water and from about 10% by weight to about 40% by weight polyethylene oxide.



9. The binder of claim 8 comprising from about 0.1% by weight to about 5% by weight xanthan gum.

10. The binder of claim 9 consisting essentially of about 79.75% by weight water, 20% by weight polyethylene oxide, and 0.25% by weight xanthan gum.

