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HARD FACING MATERIAL AND METHOD OF MAKING THE SAME

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This invention relates to hard facing material and method of making the same. The material is particularly adapted to be deposited and impregnated into the cutting surfaces of tools, as for well drilling and the like, to increase their resistance to wear.

Heretofore, various metallic carbides, such as tungsten carbide and tantalum carbide have been applied to tools, employing a matrix of cobalt, chromium, or nickel alloy materials. As a rule the particles of carbide were dispersed in the molten matrix material and then the mixture was cast into the form of rods or other pieces which either served as the tool tip or as a weld rod for depositing on to a tool by means of a gas torch.

Various carbide materials have been suggested, and attempts have been made to employ titanium carbide having a composition of the order of 80% titanium and 20% carbon.

The present invention is based upon the discovery that titanium carbide, having a high nitrogen content has superior qualities with respect to hardness. It is possible to purchase on the open market what is called "titanium nitride," but which has a composition substantially as follows:

	Per cent
Titanium-----	33
Carbon-----	7
Nitrogen-----	4.5

And the balance, iron, plus a few impurities.

This material is of very light weight, and the particles cannot be fused directly to a surface by a torch without being blown away. Furthermore, it has been found that by adding carbon to the material, a greater hardness of surface is obtained.

According to the present invention, the titanium nitride material, which for the purposes of description will be called "titanium-cyano-carbide," is mixed with a high nitrogen ferro chromium and then sintered at a suitable temperature to effect wetting of the titanium-cyano-carbide by the chromium iron alloy.

The sintering of the material is preferably done under a slight mechanical pressure and also in an atmosphere of nitrogen. Better results are obtained by mixing with the material a finely divided carbon, such as sugar carbon. An example of the materials which may be employed is as follows:

	Per cent
Tungsten carbide (24 to 200 mesh)-----	45
Titanium-cyano-carbide (40 to 200 mesh)-----	28
Ferro chromium (high nitrogen)-----	12
Sugar carbon-----	15

Another example, leaving out the tungsten carbide is as follows:

	Per cent
Titanium-cyano-carbide-----	55.95
5 Ferro chromium-----	17.65
Sugar carbon-----	26.40

The above mixtures were sintered in a crucible having a vertically movable top which applied a constant pressure on the material, the sintering being done at approximately 3400° F. for from 30 to 45 minutes.

In the sintering operation, the ferro chromium appeared to form a coating on the particles of carbide, and the briquette formed showed a yield of 97.6% by weight, and a volume reduction of about 26%. When the briquette was pulverized, it was found that the particles of carbide material had a considerably higher density approaching that of steel.

When the pulverized particles were placed in the usual tubular weld rod for deposition on the surface of a tool it was found that the particles had much less tendency to be blown away by the flame of the gas torch, and that the coating on the carbide particles softened quickly under the heat and facilitated the bonding of the particles to the surface being coated.

While ferro chromium is the best wetting agent for titanium-cyano-carbide, it is possible to use ferro molybdenum or ferro nickel at least as a partial substitute for the ferro chromium. The nitrogen content of the material after sintering appears to be increased where the sintering is done in a nitrogen atmosphere. The carbon content of the material is also increased where carbon is mixed with the material or supplied by means of reducing gases. While some of the nitrogen may escape during the subsequent welding operation, a considerable part of it remains and greatly adds to the hardness of the carbide. With ferro chromium as a matrix, the nitrogen does not appear to injure the binding element of the structure. Tests have shown that coatings of the material welded to the surfaces of a tool may have a hardness as high as 73 Rockwell C. and boring tests show a considerably greater wearing resistance than heretofore obtained with plain titanium carbide and other known carbide materials. Various embodiments of the invention may be employed within the scope of the accompanying claims.

The invention is hereby claimed as follows:

1. A tool surface formed of particles of titanium-cyano-carbide, embedded in a matrix of a chromium iron alloy.
2. A sintered product composed of titanium-cyano-carbide, and ferro chromium.

3. The method of increasing the weight of titanium-cyano-carbide particles to facilitate deposition of the same for hard-surfacing, which comprises coating the particles with an iron chromium alloy wetting agent.

4. The method of making hard-surfacing material which comprises mixing titanium-cyano-carbide, ferro chromium and carbon in a finely divided state, and sintering the same at a temperature sufficient to fuse the ferro chromium into a matrix, coating the particles of carbide material therewith.

5. The method of making a hard surfacing material comprising sintering titanium-cyano-carbide, and a low melting point iron chromium alloy in the presence of carbon.

6. The method of making a hard surfacing material comprising sintering titanium-cyano-car-

bide, and a low melting point iron alloy in a nitrogen atmosphere.

7. The method of making a hard surfacing material comprising sintering titanium-cyano-carbide, and a low melting point iron alloy in the presence of carbon and in a nitrogen atmosphere.

8. The method of making hard surfacing material which comprises mixing finely divided carbide materials and other materials in substantially the following proportions:

	Per cent
Tungsten carbide.....	45-0
Titanium cyano carbide.....	28-56
Ferro chromium.....	12-18
Sugar carbon.....	15-26

and sintering the mixture in a nonoxidizing atmosphere substantially of nitrogen.

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