EXAMPLE 1

In this Example a sample of 304L alloy was melted and atomized utilizing different combinations of process gas atmospheres. The nitrogen content as a function of the process parameters is listed in Table I below.

TABLE I

Melt Backfill Gas	Atomizing Gas	Wt. % Nitrogen
Argon	Argon	0.025
Argon	Nitrogen	0.077
Nitrogen	Argon	0.157
Nitrogen	Nitrogen	0.148
Nitrogen	Nitrogen	0.206*

*22 wt. % Cr 304L alloy

From the data in Table I it is observed that melting under a nitrogen atmosphere has a greater effect on the wt. % of nitrogen in the final alloy than atomizing with nitrogen. However, atomizing with nitrogen did contribute to the wt. % nitrogen in the final alloy. The results of this example are further illustrated in FIG. **1** which is a bar graph of the weight percent of nitrogen for each of the first 4 samples listed in Table I.

EXAMPLE 2

In this example samples of 304L alloy produced utilizing the different combinations of process gas atmospheres of Example 1 above were investigated for the formation of hollow particles. FIGS. *2a–2e* are photomicrographs of the stainless steel powder samples. The legends in FIGS. *2a–2e* indicate the combination of process gases utilized. The first gas listed in the legend is the melt backfill gas and the second listed gas is the atomizing gas.

As illustrated in FIGS. *2a* and *2c*, a number of the argon atomized stainless steel particles were hollow as shown by the dark areas in the center of the particles. In contrast, the nitrogen atomized stainless steel particles illustrated in FIGS. *2b*, *2d* and *2e* contained essentially no hollow particles.

This result indicates that the critical factor in reducing the number of hollow particles is the process gas utilized in the gas atomization step.

The results of this example are further illustrated in FIG. **3** which is a bar graph of the fraction of hollow particles (%) for each of the different combination of process gases.

EXAMPLE 3

In this example samples of 304L alloy produced utilizing the different combinations of process gas atmospheres of Example 1 above were investigated for mechanical properties. The samples were compacted utilizing a hot isostatic press and tested for yield stress (0.2%), flow stress (5%), and hardness.

FIG. **4** is a bar graph illustrating the 0.2% yield stress and 5% flow stress of the 304L stainless steel samples as a function of strength and processing parameters. In FIG. **4** the first gas listed in the legend is the melt backfill gas and the second listed gas is the atomizing gas. The material designated storeroom is a comparable commercially available stainless steel which was not processed by powder metallurgy methods.

As observed from FIG. **4**, the samples processed with both a nitrogen melting atmosphere and with nitrogen as the atomizing gas demonstrated superior yield stress and superior flow stress. Moreover, the sample melted under a nitrogen atmosphere and atomized with argon showed a significant increase in yield strength and flow stress.

The results of this example are further illustrated in FIG. **5** and **6** which are graphs of the 0.2% yield stress and 5% flow stress of the powder metallurgy processed stainless steel as a function of nitrogen content, and of hardness of the powder metallurgy processed stainless steel as a function of nitrogen content.

As illustrated in FIGS. **5** and **6**, the yield stress, flow stress, and hardness increase linearly with nitrogen content.

The results of the above examples indicate that in order to produce a powder alloy having a high nitrogen content and a minimum amount of hollow particles it is necessary to utilize nitrogen both as the melt backfill and as the atomizing gas in the gas atomization step. As noted above, utilizing nitrogen as the melt backfill insures that a significant amount of nitrogen is added to the alloy. On the other hand, utilizing nitrogen for the atomizing gas in the gas atomization step insures a minimum formation of hollow particles. In this regard, it is believed that during gas atomization, the nitrogen in any nitrogen bubbles created during gas atomization is adsorbed into the metal alloy an quenched in the powder due to the high cooling rate and fine particle size characteristic of gas atomization. In contrast, utilizing argon or helium would cause the formation of hollow particles since these gases are not adsorbed by the alloy. Therefore, it is possible according to the present invention to melt an alloy under any atmosphere, including argon, helium, nitrogen, etc., and still avoid or reduce the formation of hollow particles by performing gas atomization utilizing nitrogen as the atomixing gas.

Although the invention has been described with reference to particular means, materials and embodiments, from the foregoing description, one skilled in the art can easily ascertain the essential characteristics of the present invention and various changes and modifications may be made to adapt the various uses and conditions without departing from the spirit and scope of the present invention as described by the claims which follow.

We claim:

1. A method of producing a nitrogenated metal alloy powder which comprises the following steps:

(a) melting a metal alloy under a nitrogen atmosphere to increase the nitrogen content of said alloy and thereafter

(b) subjecting said molten alloy to a gas atomizing process to produce solid, substantially spherical shaped nitrogenated metal alloy particles, wherein nitrogen is utilized as the atomizing gas in said gas atomizing process and said gas atomization process is controlled so that nitrogen provided to increase said nitrogen content in step (a) is absorbed into the resulting metal alloy particles.

2. A method of producing a nitrogenated metal alloy powder according to claim **1**, wherein said nitrogen containing atmosphere utilizing during the melting is at a pressure of about 1 atmosphere.

3. A method of producing a nitrogenated metal alloy powder according to claim **1**, wherein less than about 1 percent of the metal alloy powder particles produced by the gas atomization step include hollow particles.

4. A method of producing a nitrogenated metal alloy powder according to claim **1**, wherein said metal alloy is selected from the group consisting of steels, nickel alloys, aluminum alloys and titanium alloys.