Metal powders are the base materials for the production of metallic component through the conventional powder metallurgy route or the emerging field of additive manufacturing. In any of these process routes, the properties of the finished product depends on the character of the base powder from which it is produced which is equally dependent on the process of production of the base powder. Therefore, there are different methods for producing metal powders with each method offering different particle morphology and purity. These methods include crushing (for brittle material), machining, mechanical pulverization, slotting, electrolysis, atomization of liquid metal using water, nitrogen, argon, or a combination of these, and reduction of metal oxides in hydrogen or using carbon. These metal oxides could be materials such as iron ore or iron oxide generated from pickling plants, in steel strip mills. Other methods include reduction of metal oxide with higher carbon containing, metal powder, chemical decomposition of metal carbonyls, and electrolytic processing of cathodic deposition from molten metal salts; and in some instances, recycling (Sharma, 2011). Each of these methods provides different particle morphology and characteristics. An illustration of

typical powder shapes produced from some of these processes is shown in Figures 1 and 2.

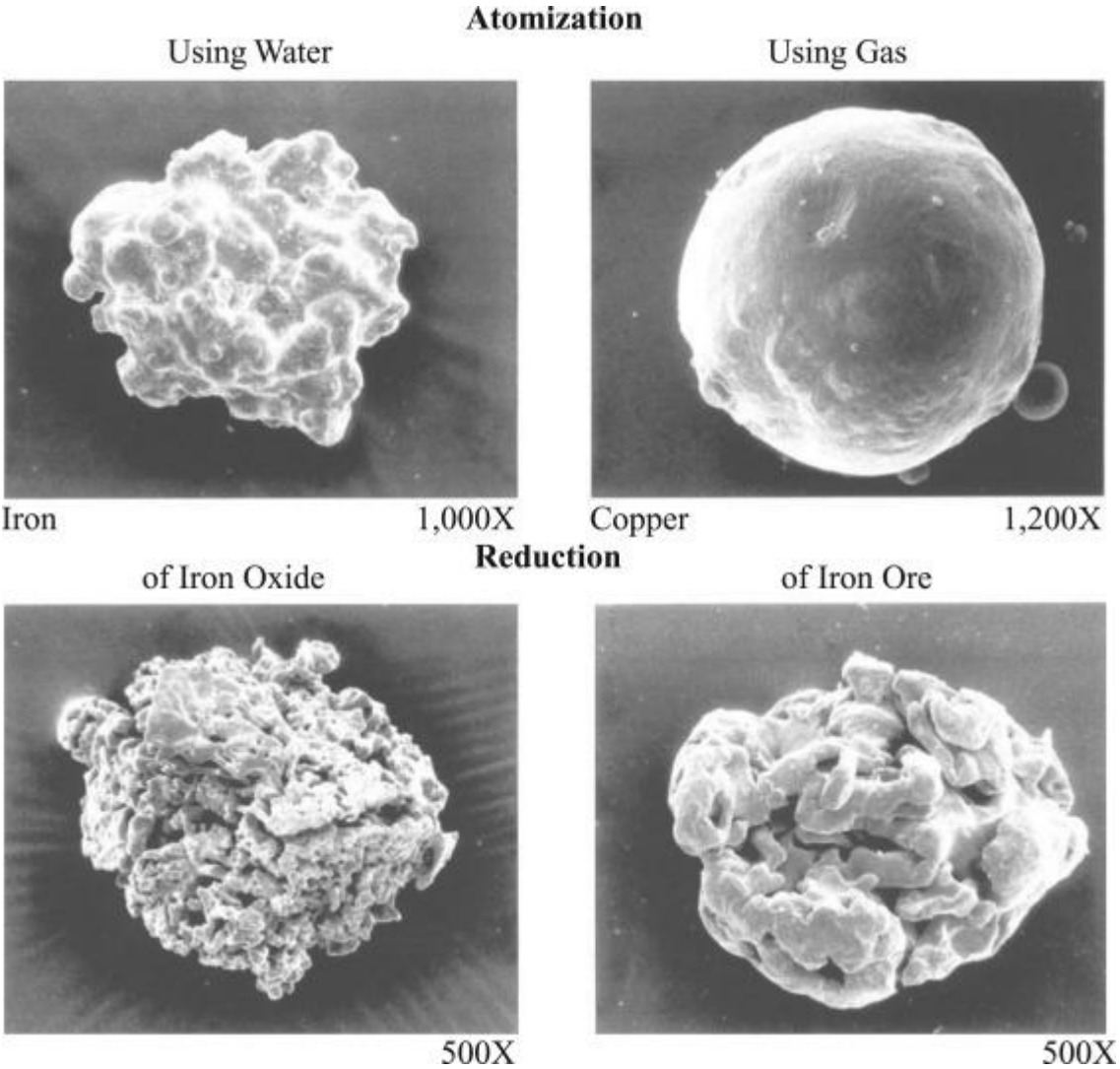

Figure 1. Morphology of metal powders made by various manufacturing processes (atomization/reduction).

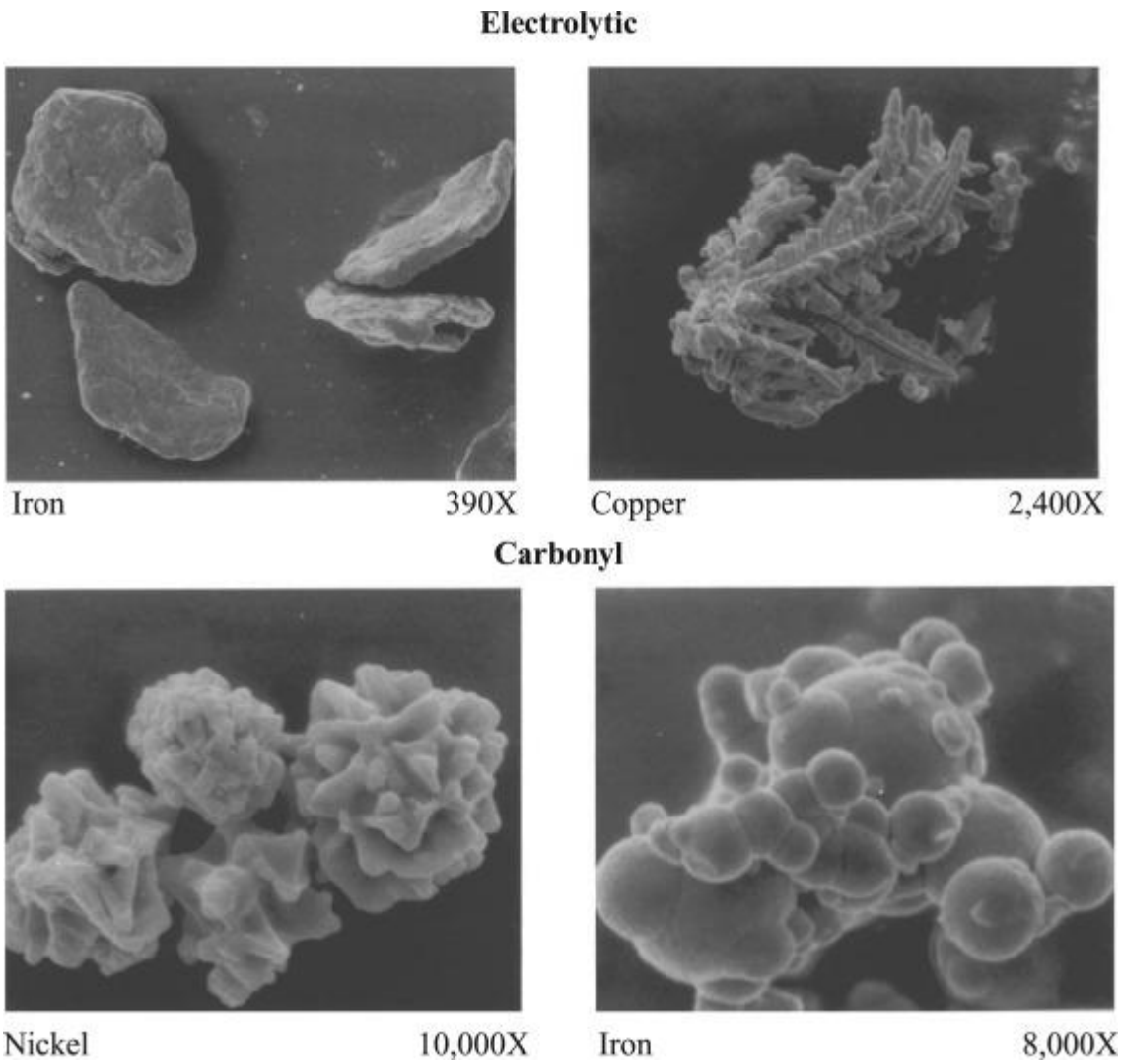

Figure 2. Morphology of metal powders made by various manufacturing processes (electrolytic/carbonyl)

Metal powders must exhibit consistent powder characteristics in ensuring repeatable manufacture of metal parts . For instance, metal powders use in additive manufacturing are assumed to be nominally spherical, and have a particle size distribution that is designed to facilitate good packing behavior, such that the final manufactured part has good mechanical properties and is fully dense. Other characteristics include morphology, density, chemical composition, flowability, green

strength surface area, compressibility, and sintering ability and thermal properties. The main characteristics of powders are the particle size (granulometry) and particle shape (morphology). Technological properties of powders (bulk density, flowability, surface area, compressibility, green strength, and thermal) as well as the potential areas of their application depend on these characteristics ; and there must exist means of adequately elucidating these characteristics in term of repeatable procedures and standards. Brackx et al. (2015) identified characteristic features for profiling powder specification and quality; and listed these as including their physico-chemical properties, chemical compositions and purity, morphology, apparent or packed density, specific surface, granulometry, and grain porosity.