NCAMP-DRAM Appendix One: Metals

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Appendix A – Metal

This appendix further supports and defines the requirements to generate basic material property data with sufficient pedigree and control for submission, approval, and appropriate dissemination in accordance with the National Center for Advanced Materials Performance - Defense Rapid Advanced Manufacturing's (NCAMP-DRAM) standard operating procedure (SOP) (document number NCD 100).

1. Additive Manufacturing

Initial Material Qualification (IMQ), as defined in NCD 100, requires metadata, material data, and material specifications and standards. Requirements for each of these categories will be drafted in future revisions of this appendix. This version includes examples of the types of information that will be required.

1.1 IMQ Material Metadata

Examples of material meta data are:

- Classification level (e.g. CUI)
- Data distribution statement
- Material pedigree class (e.g. 0-3)
- Material name
- Process method (e.g. LPBF)
- Data source
- Date of entry
- Feedstock source
- Feedstock specification
- Number of lots
- Powder reuse number
- Machine make and model
- Machine serial number
- Chamber gas
- Pre-heat temperature
- Layer thickness
- Parameters set name
- Recoater material
- Thermal processing
- Surface condition
- Orientation

1.2 IMQ Material Data

Example of IMQ data elements:

- Chemistry
- Density
- Metallography

- Hardness
- Static properties
    - Tensile
    - Compressive
    - Shear
    - Bearing
    - Elongation
    - Reduction of area
    - Modulus
    - Test temperature
    - Coupon geometry
- Fatigue
    - High Cycle Fatigue (HCF)
    - Low Cycle Fatigue (LCF)
    - Strain controlled
    - Load controlled
    - R-ratio
    - Test temperature
    - Machined surface
    - As-printed surface
    - Coupon geometry
- Material Specification
    - Thermal processing
    - Chemical composition tolerance
    - Minimum ultimate tensile
    - Minimum yield strength
    - Minimum elongation
    - Maximum Porosity
    - Grain size tolerance
    - Microstructure requirements
    - Min LCF

1.3 Material Specifications and Standards

A laser powder bed fusion (LPBF) example of the relationship between specifications and standards is shown in Figure 1. The standards and specifications for each material and process must be included or publicly available for data submitted for IMQ.

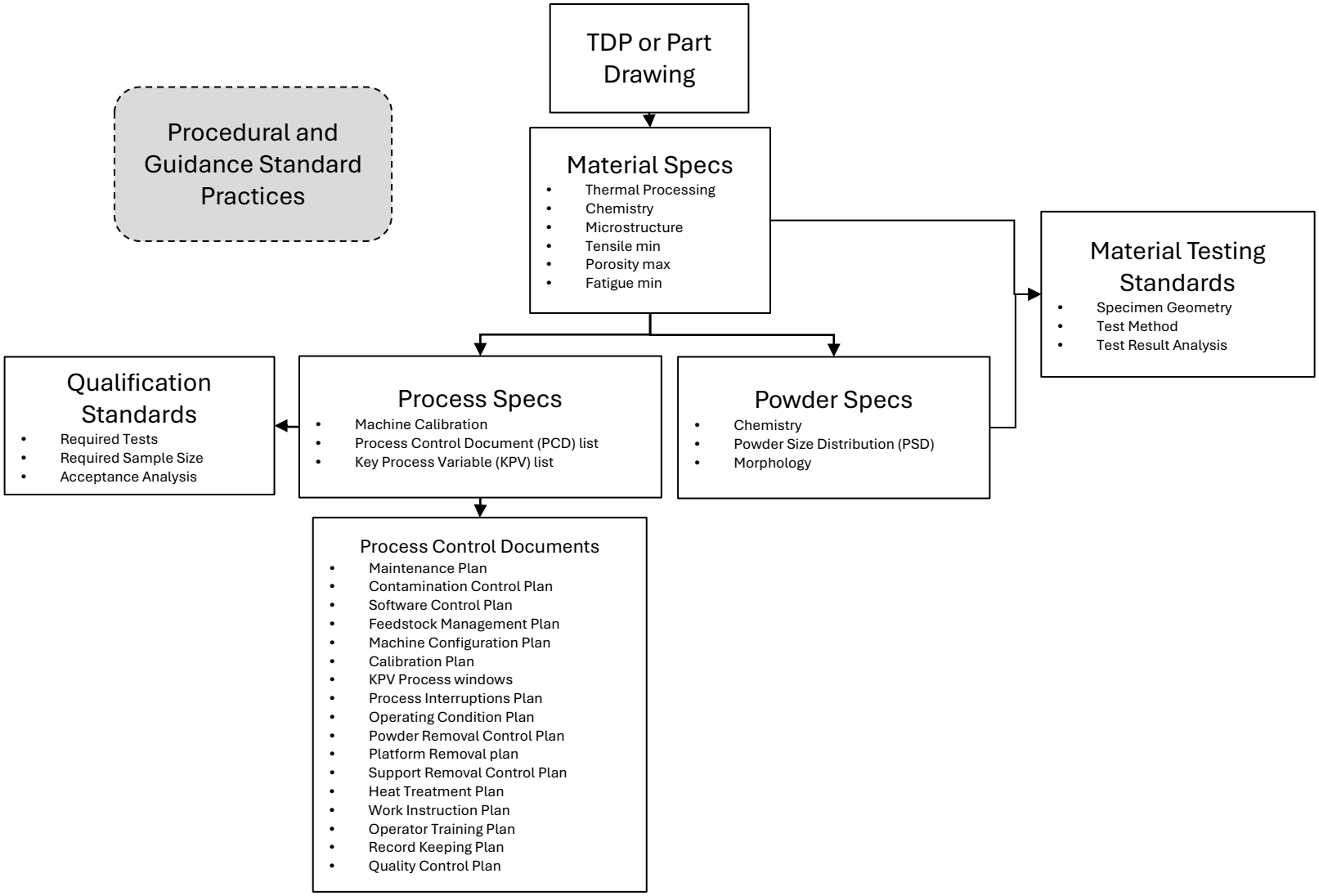

Figure 1. *Relationship between Standards and Specifications*