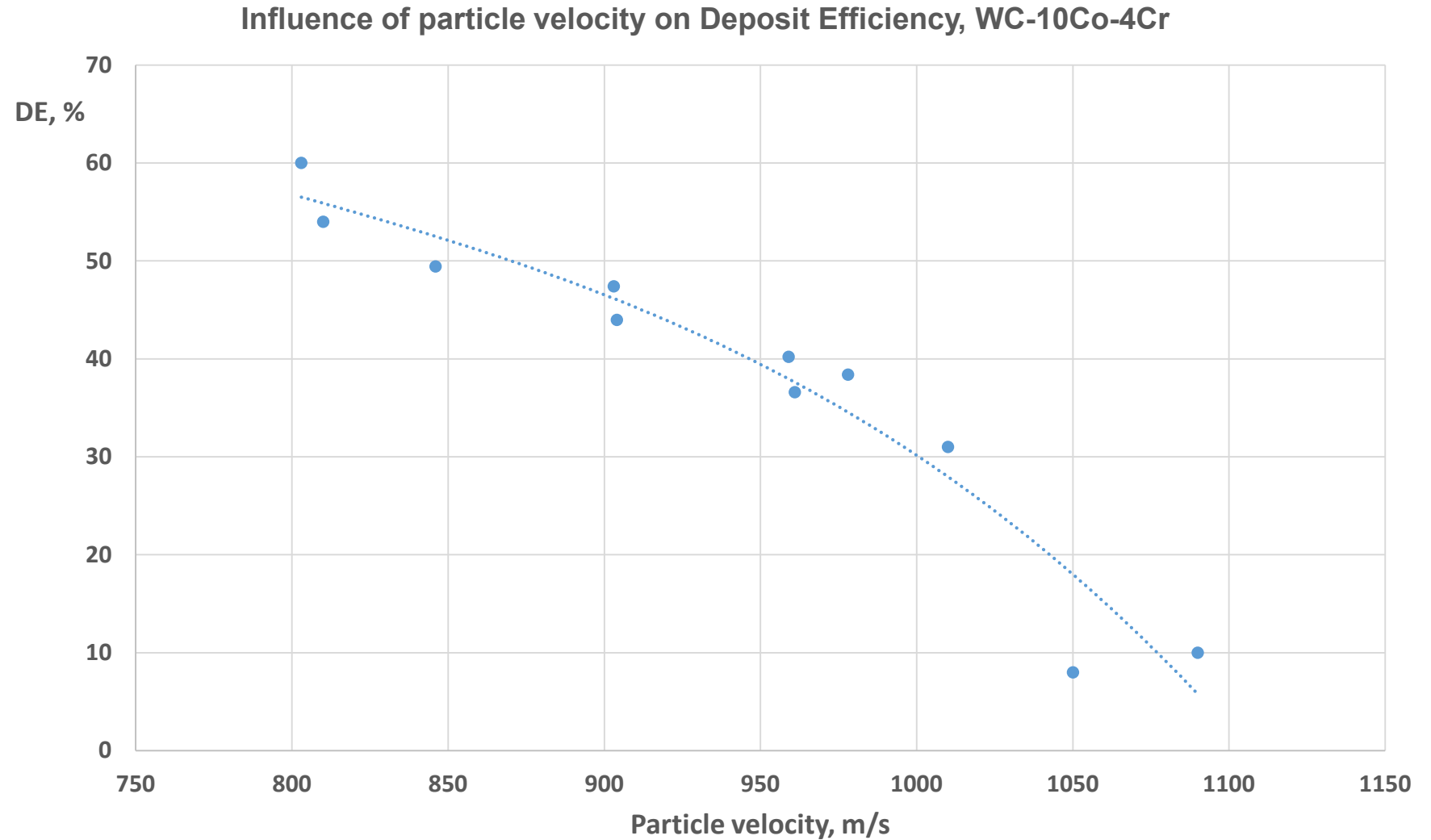


Few Aspects of HVAF and HVOF Spraying of WC-coatings

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1. Spray particle velocity



Spray particle velocity (cont.)

The increase of spray particle velocity:

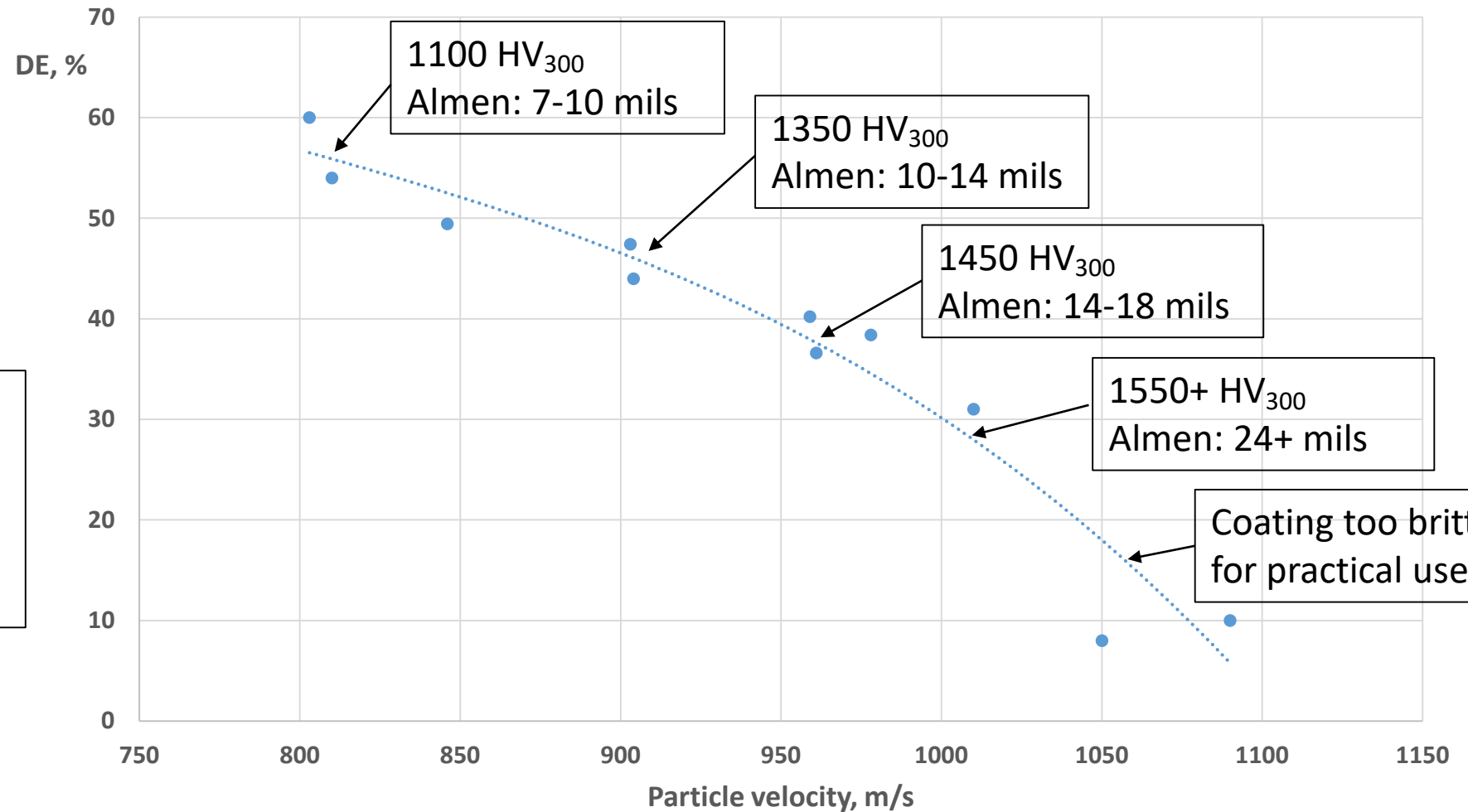
- **Increases the contact pressure upon impact => increases DE and cohesion strength**
- **Increases destruction of materials, both the substrate (cracking/ erosion) and the spray particle
=> decreases DE and eventually weakens the coating material**

In case of WC-10Co-4Cr agglomerated/sintered powder, grain size of WC – “Fine” (1 micron), the “destruction component” prevails at particle velocities over 800 m/s; it becomes severe at particle velocity over 970 m/s.

When using similar materials with “Medium” (1.5 micron) and “Coarse” (2.5 micron) WC grain size, the “destruction component” becomes noticeable at 700 m/s or earlier.

Spray particle velocity (cont.)

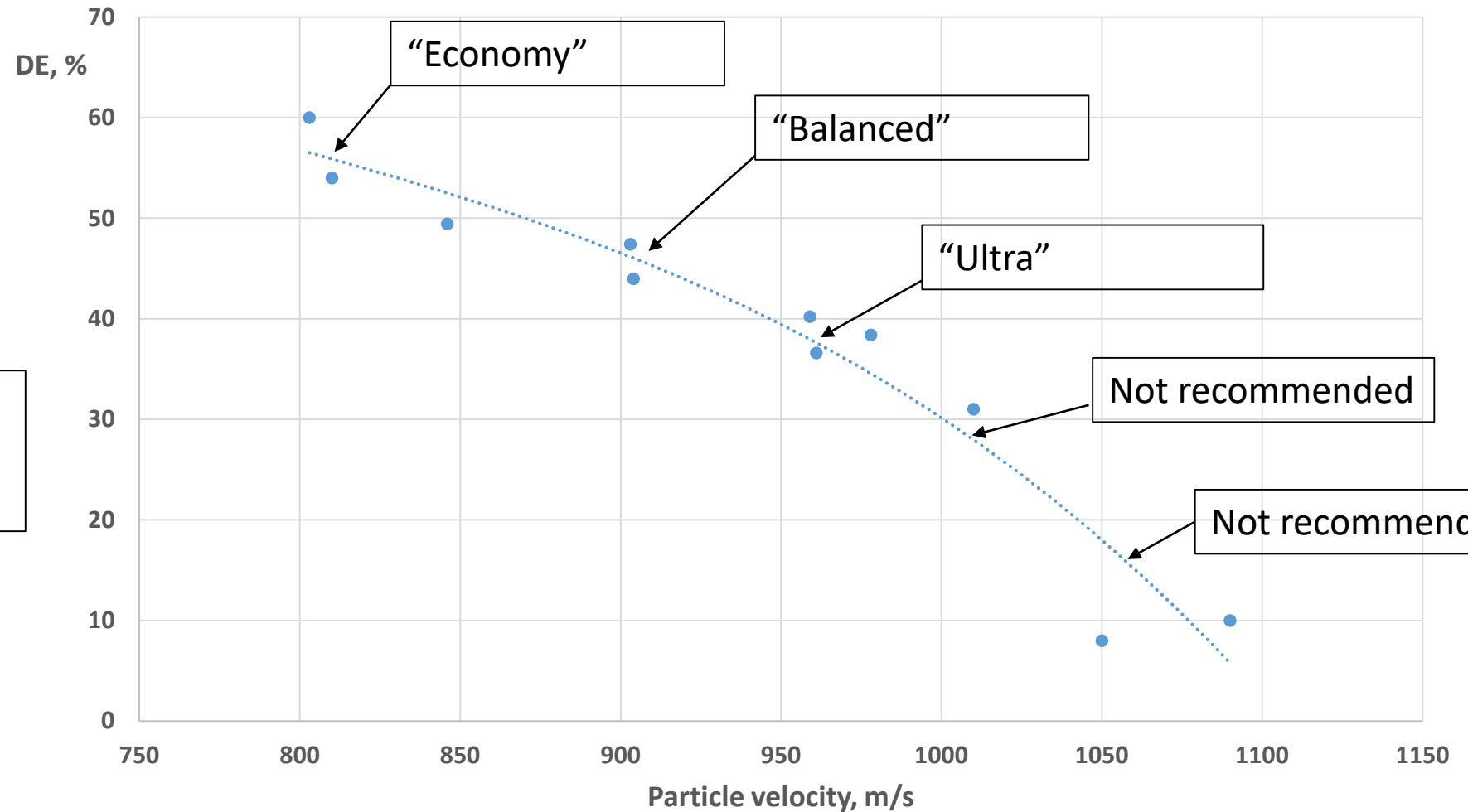
Influence of particle velocity on Deposit Efficiency, WC-10Co-4Cr



Note about residual stresses:
Typical "Almen requirements" in aviation: 4...14 mils

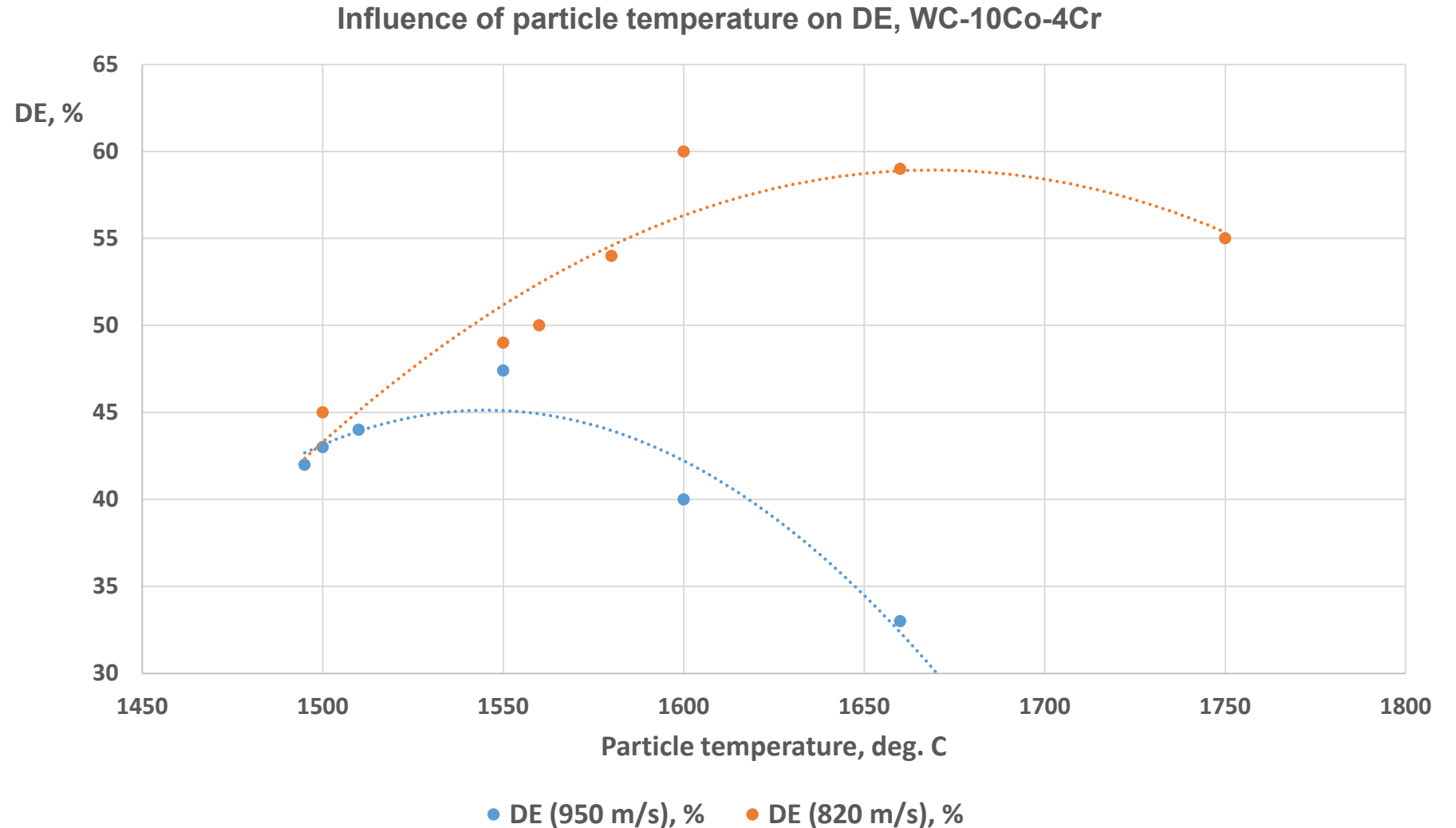
Spray particle velocity – Practical application

Influence of particle velocity on Deposit Efficiency, WC-10Co-4Cr



Kermetico-
designated modes
of HVOF spraying

2. Spray particle temperature



Spray particle temperature (cont.)

The increase of spray particle temperature:

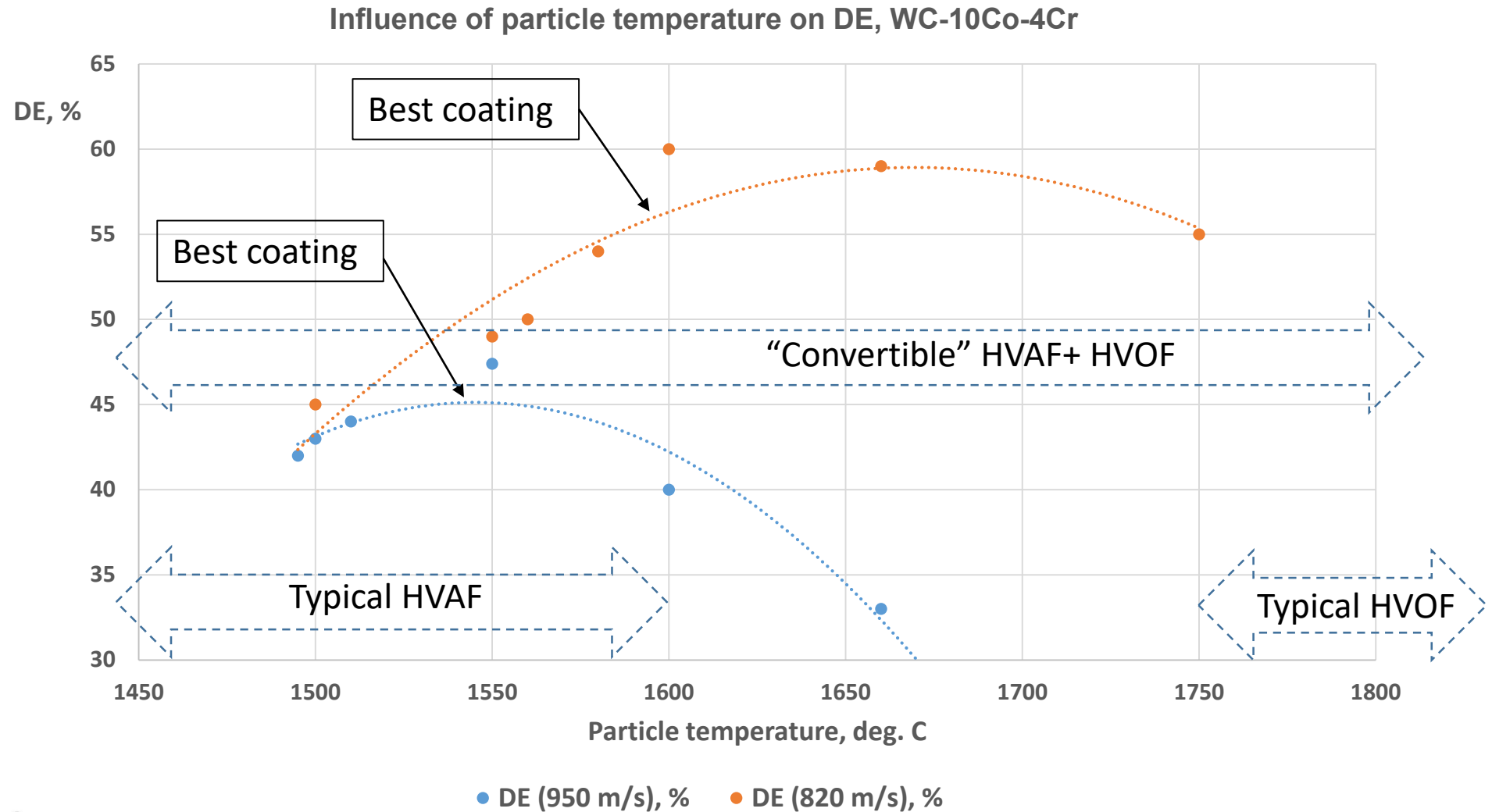
- **Increases the particle-substrate contact temperature => increases DE and cohesion strength**
- **Weakens the spray particle resulting in its destruction during impact => decreases DE and produces coating defects**

The DE increases with the increase of spray particle temperature until the temperature reaches some critical level (“critical temperature”). The increase of particle temperature over “critical” temperature results in the drop of DE. At this point, the increase of porosity, oxides content and decarburization accelerate.

The “critical temperature” of spray particles decreases with the increase of spray particle velocity.

The best coating quality is achieved BEFORE the particles reach their “critical temperature”.

Spray particle temperature (cont.)



Spray particle temperature: Convertible Systems

Kermetico “Convertible” guns and systems allow adding the controlled amounts of oxygen into combustion air to gradually increase the temperature of the combustion products. This results in gradual increase of spray particle temperature, while practically not affecting their velocity. Without oxygen, the guns operate in HVOF mode. With oxygen – in HVOF mode.

Beneficial effects of “Convertible” technology are found for:

- Spraying of HVOF-spec carbide powders, optimizing particle temperature to reach maximal DE at specified coating quality (hardness, porosity, oxides content, etc.). The spray rates are typical for HVOF guns (up to 32 kg/hour).
- Spraying of high quality carbide coatings at very shallow angle of attack (25-27 degrees) by optimizing spray particle temperature below “typical HVOF” spraying but above “typical HVOF”
- Spraying of “hard” and “stiff” materials, such as WC-30WB-10Co
- Spraying of dense hard metals, etc.