Load Sharing and Failure Mechanisms in Cold Spray Ni-CrC Composites: a Synchrotron X-ray Diffraction Study

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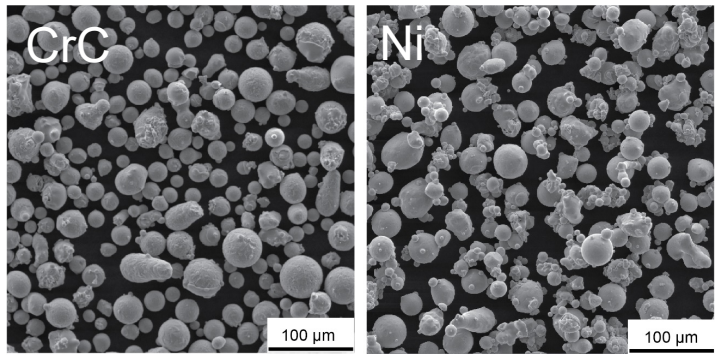
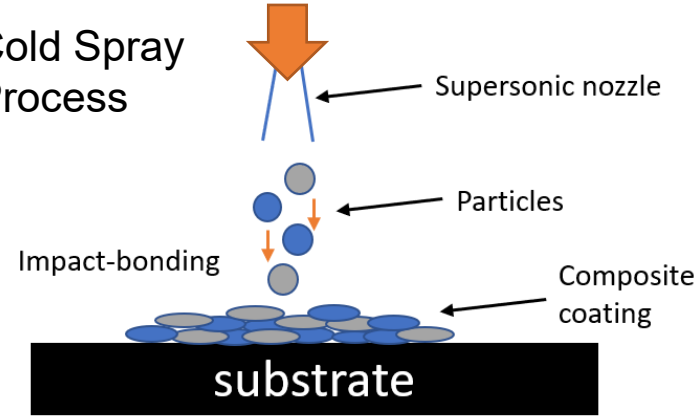
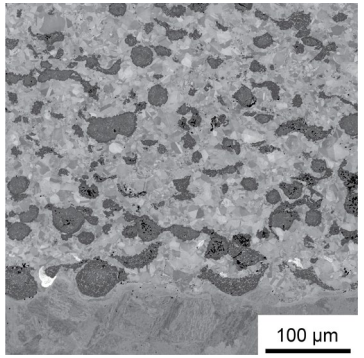
Powder Feedstock



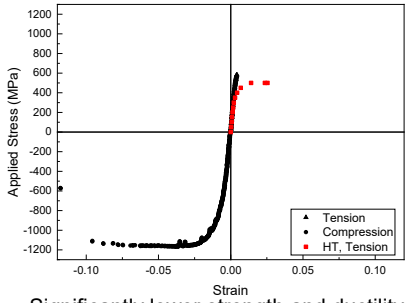
Cold Spray Process





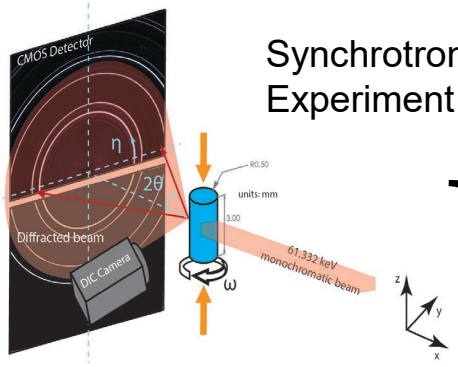
- ❑ Dense composite achieved without melting and significant alteration of phase composition and chemistry
- ❑ MMC shows improved mechanical response compared to single phase deposits

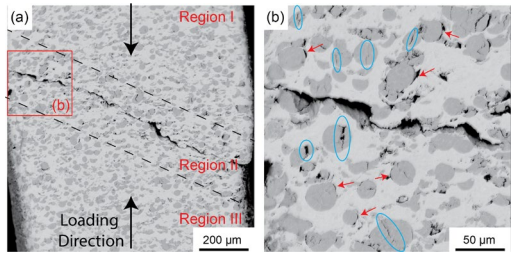
Macroscopic Response



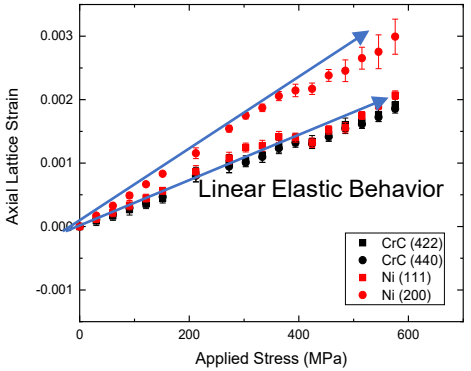
- Significantly lower strength and ductility in tension than in compression
- Defect induced failure in tension
- More gradual failure in compression
- Failure surface analysis in compression shows areas of defect concentrations (Region II):
  - Imperfect interfacial bonding
  - Reinforcement fracture
- Localized tensile stress causes such failure
- Enhance performance by reducing defects

Synchrotron XRD Experiment

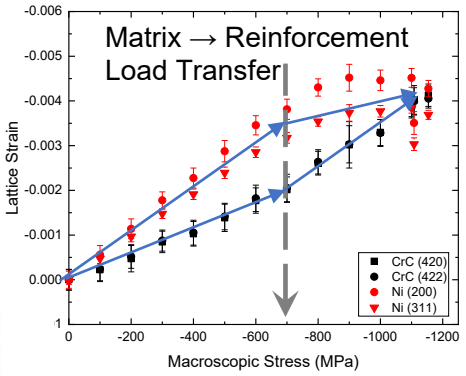




Phase Specific Response, Tension



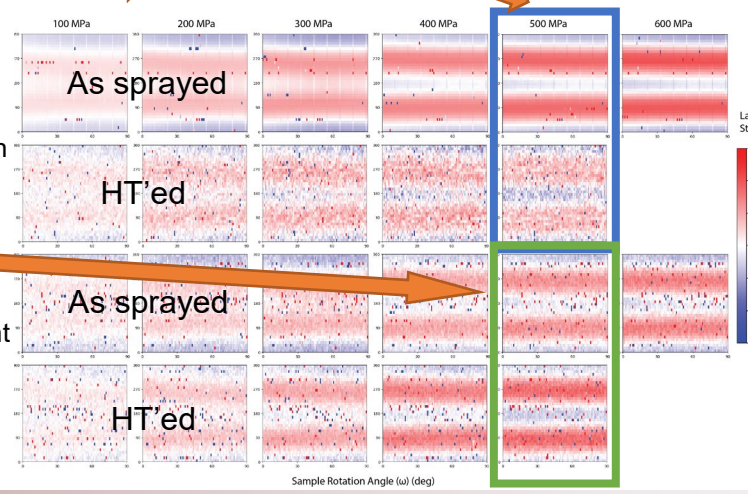
Phase Specific Response, Compression



Effect of Heat Treatment

Heat Treatment → Matrix thermal softening; Earlier yielding → Lower lattice strain in HT'ed matrix

Heat Treatment → Better bonding, More effective load transfer → Higher lattice strain in HT'ed reinforcement



Future Work: Computed Tomography analysis