

Aim

Create magnetic blood filters using an additive manufacturing, combustion, and reduction process.

Motivation

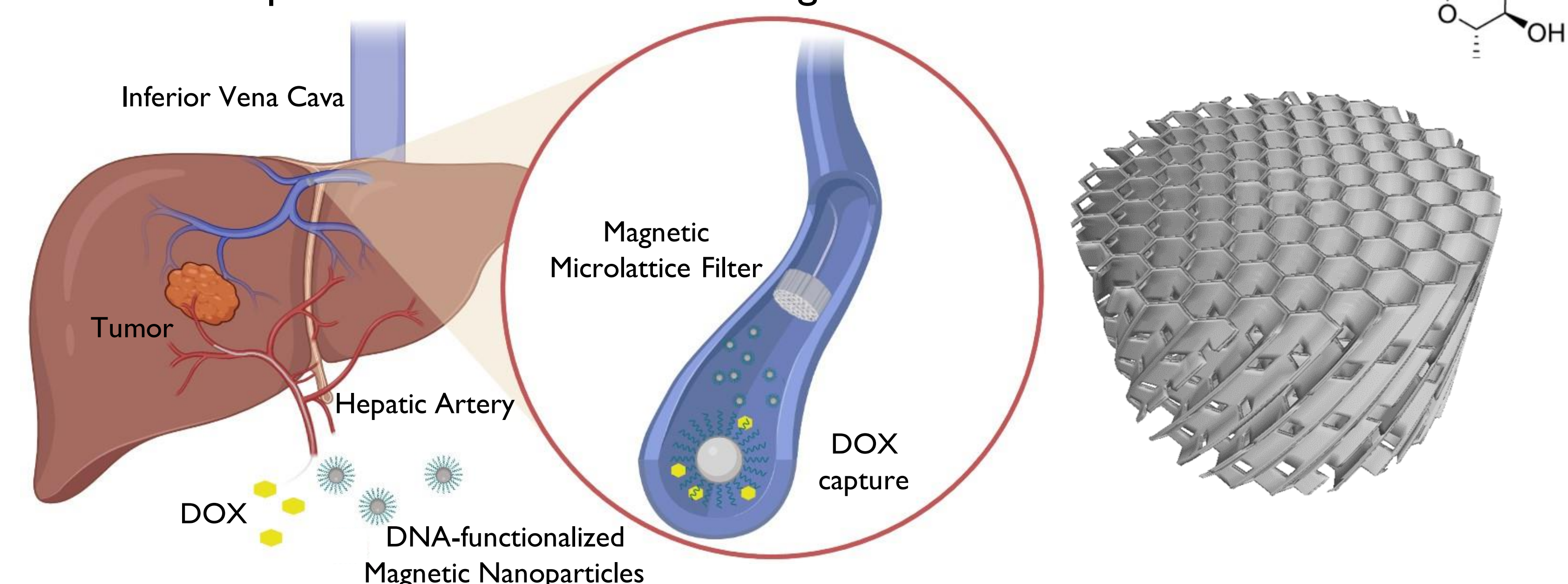
Inoperable hepatocellular carcinoma

- Leading cause of cancer death¹
- Requires advanced treatments, e.g., targeted chemotherapy with doxorubicin (DOX)²

Chemotherapy has severe off-target effects

Capture excess DOX with DNA coated magnetic nanoparticles²

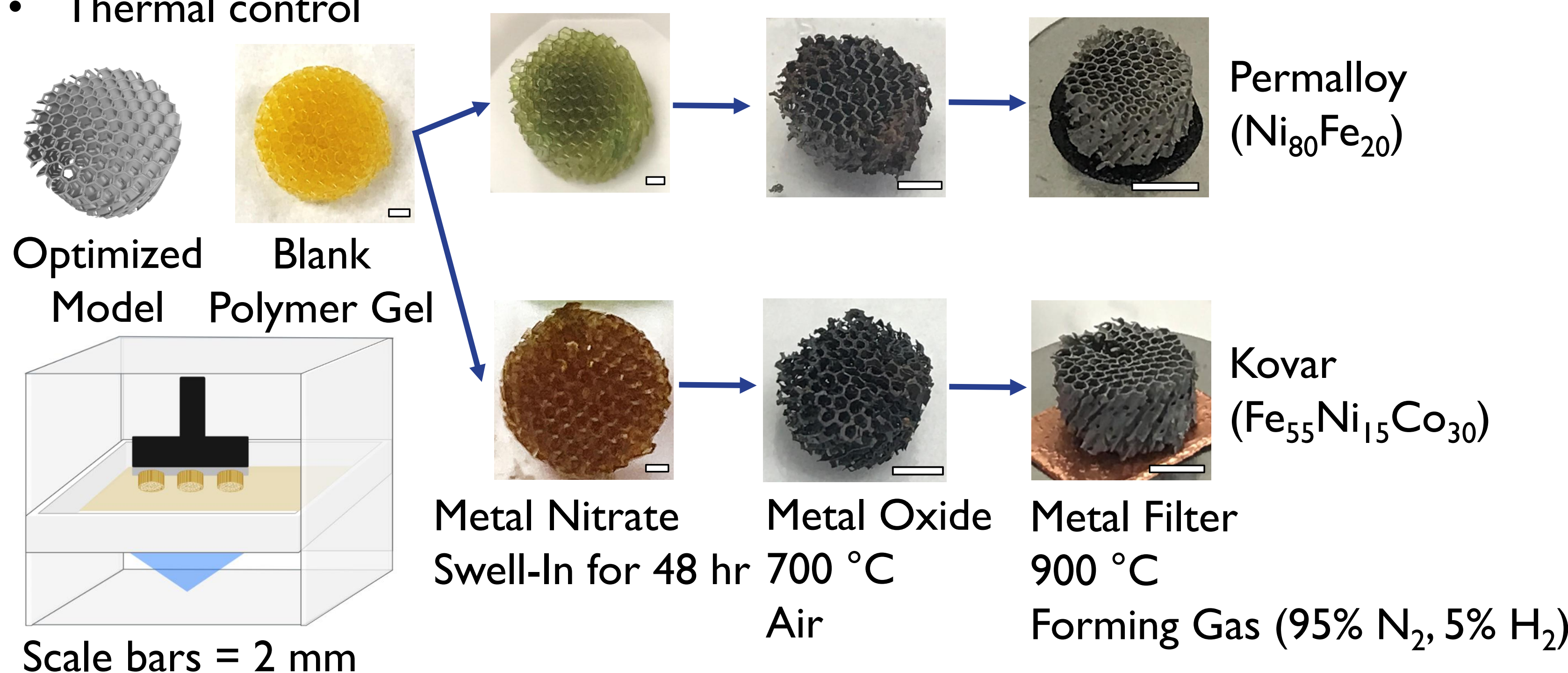
Retrieve nanoparticles with intravenous magnetic filter



Materials and Methods

Hydrogel Infusion Additive Manufacturing (HIAM) technique³

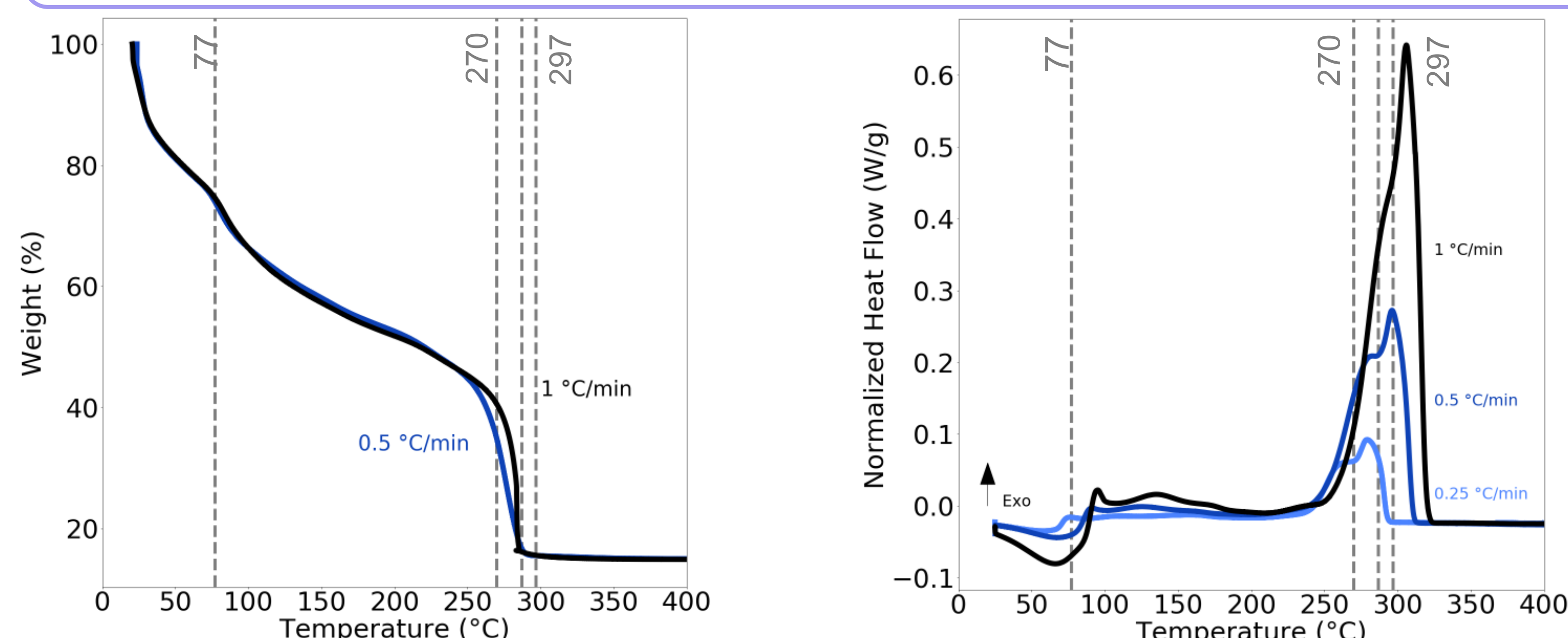
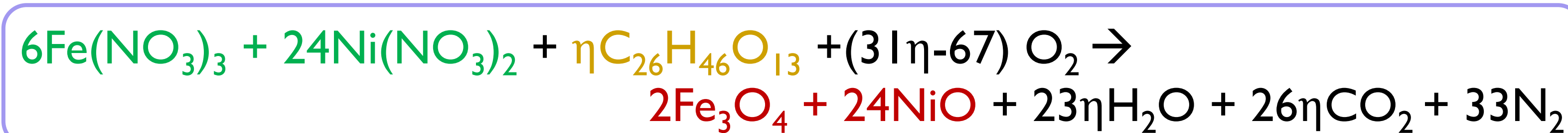
- Stereolithographic resolution
- Versatile and homogenous incorporation of metals of interest
- Thermal control



Thermal Analysis of Permalloy Gel

Thermogravimetric analysis and differential scanning calorimetry of Ni₈₀Fe₂₀ gel:

- Dehydration <100 °C
- Concerted combustion
- Normalized enthalpy: 638-1291 kJ/mol

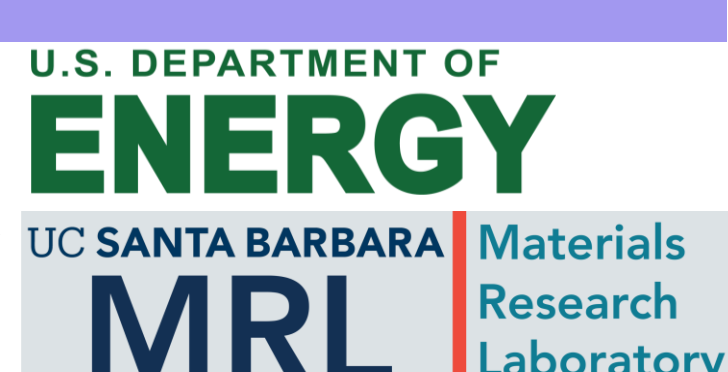


References

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Acknowledgments

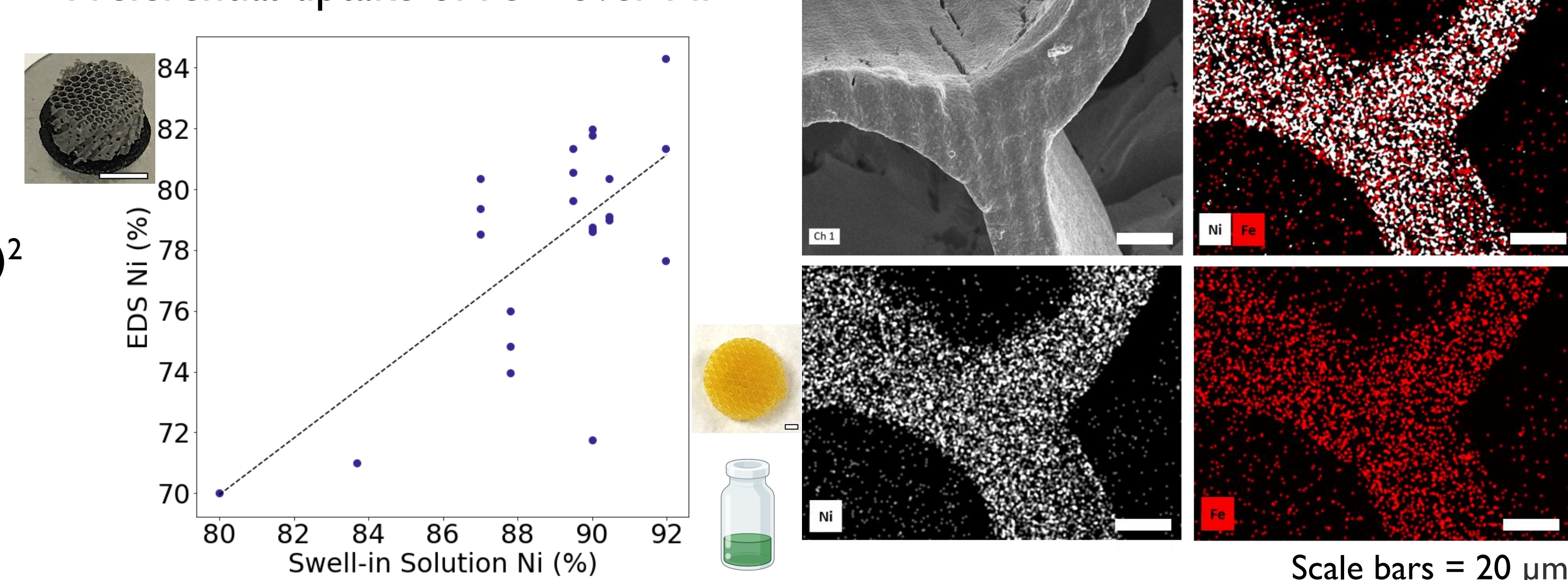
The presenter would like to thank members of the Greer group for their support. Additional thanks to Dr. Amanda Strom for collecting magnetic hysteresis loops on our samples. This project was funded in part by the SFP office and the Donald S. Clark Fellowship. SS is supported by the UCLA-Caltech MSTP through the NIH NIGMS training grant T32 GM008042 and the Merkin Institute for Translational Research.



Permalloy Composition, Phases, and Magnetic Properties

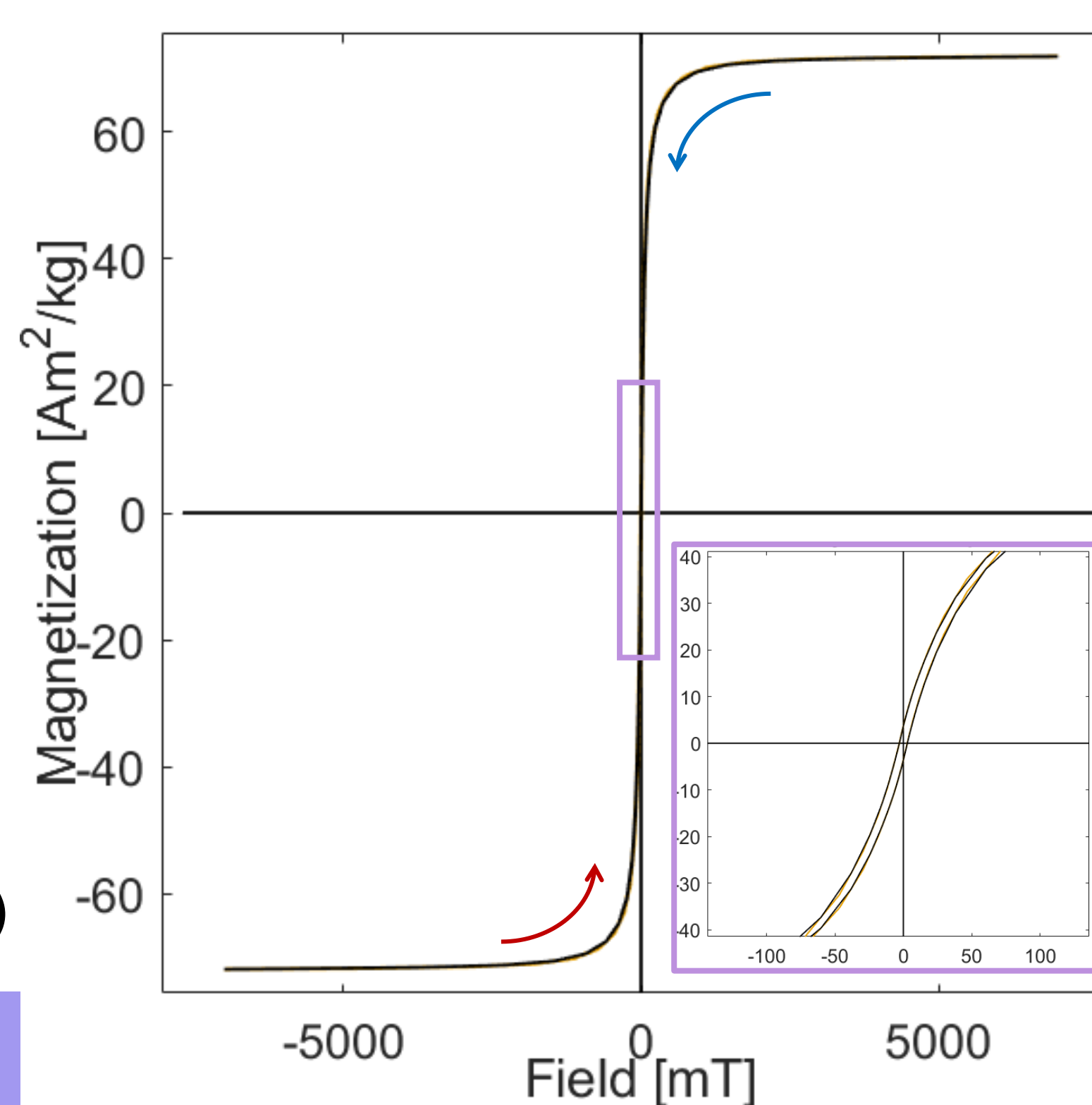
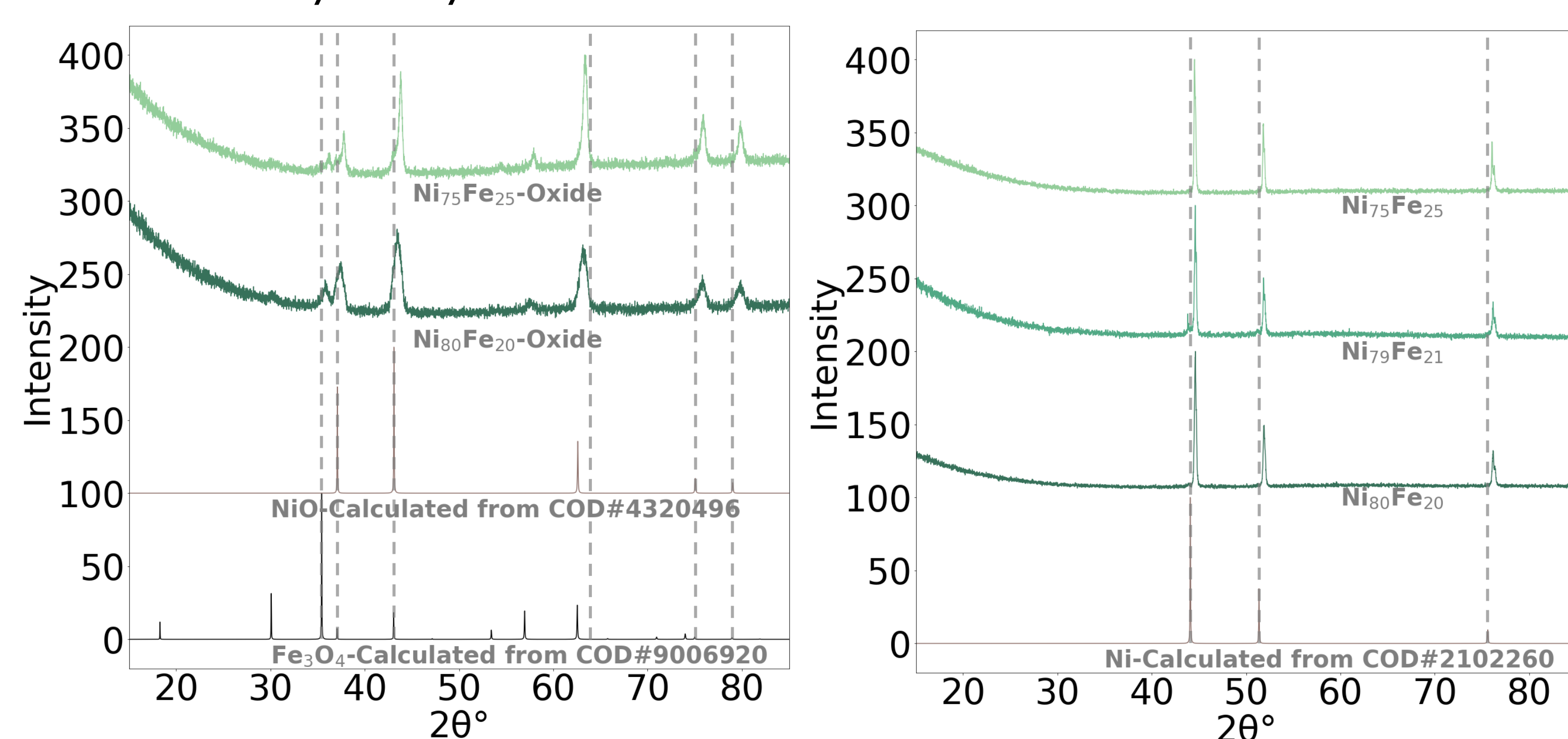
Energy Dispersive Spectroscopy (EDS) maps provide final elemental composition

- Preferential uptake of Fe³⁺ over Ni²⁺



X-Ray Diffraction (XRD) shows biphasic oxide and monophasic metal phases

XRD collected by Sammy Shaker



Magnetic Hysteresis Loop

Collected by Dr. Amanda Strom

- Low coercivity
 - Negative remanent magnetization
- Potential Instrument Effect

Saturation: maximum magnetization (M)
Remanence: remaining M without external field
Coercivity: opposing field to demagnetize

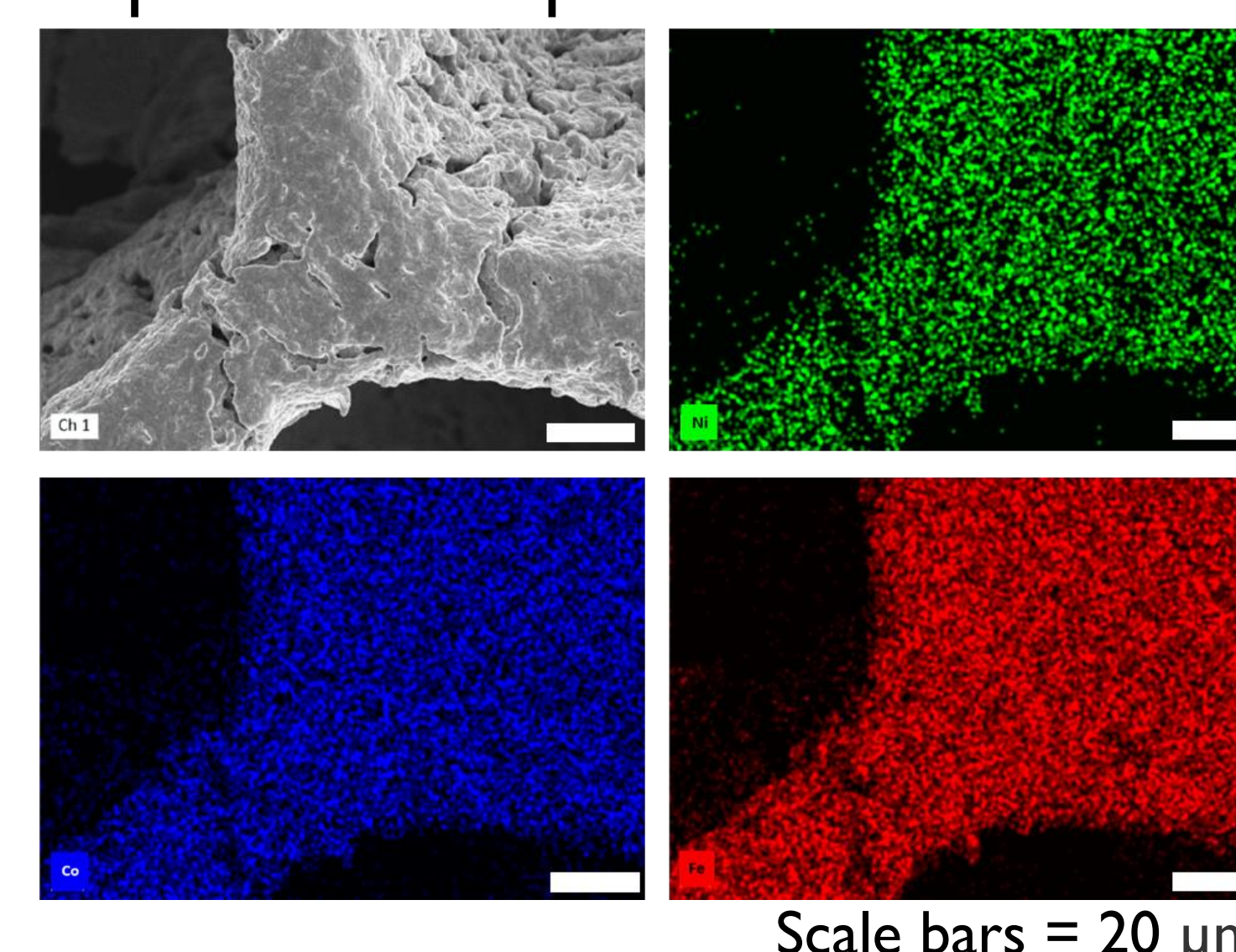
	Measured	Ref. ^{4,5}
Saturation (Am²kg ⁻¹)	70.9 ± 0.5	70-78
Remanence (Am²kg ⁻¹)	-3.9 ± 0.4	0.6
Coercivity (mT)	2.8 ± 0.4	0.4-10

Results for Kovar

Surface defects from high Fe and Co content

EDS mapping shows homogenous distribution of metal elements

Monophasic and biphasic reflections from XRD



XRD collected by Sammy Shaker

