Universität Bremen

Gas Phase Synthesis of Metal sulfides

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Particles & Process Engineering

IWT
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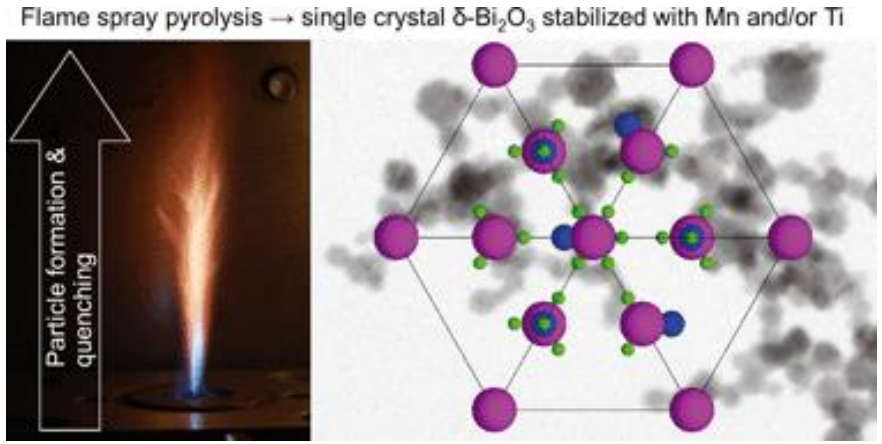
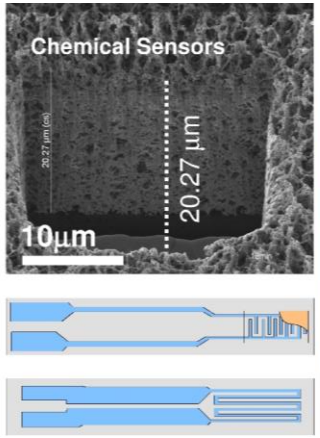
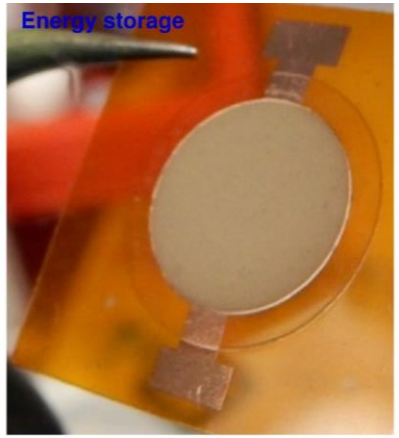
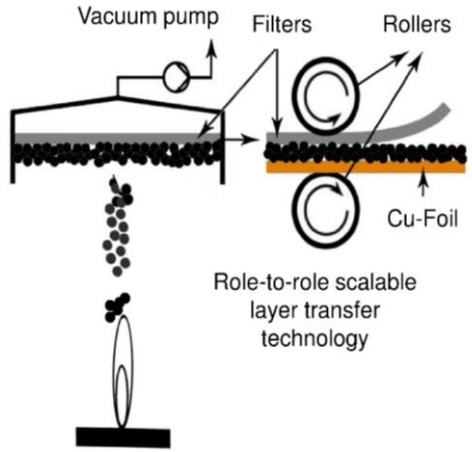
Flame-Made Metal Oxides: State-of-the-Art Applications









Metal Oxides: > 20 years of experience; Can we go beyound oxides?

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Nature Communications **11**, Article number: 3078 (2020) | Cite this article

EUROSENSORS 2015

Metal sulfides as a new class of sensing materials

V. Guidi[a,b,c*], B. Fabbri[a,b], A. Gaiardo[a,d], S. Gherardi[a], A. Giberti[c], C. Malagù[a,b], G. Zonta[a,b], P. Bellutti[d]

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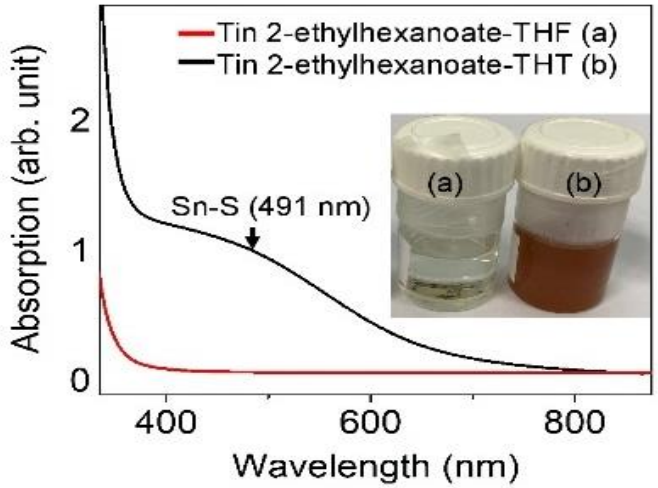
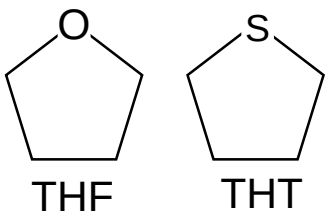
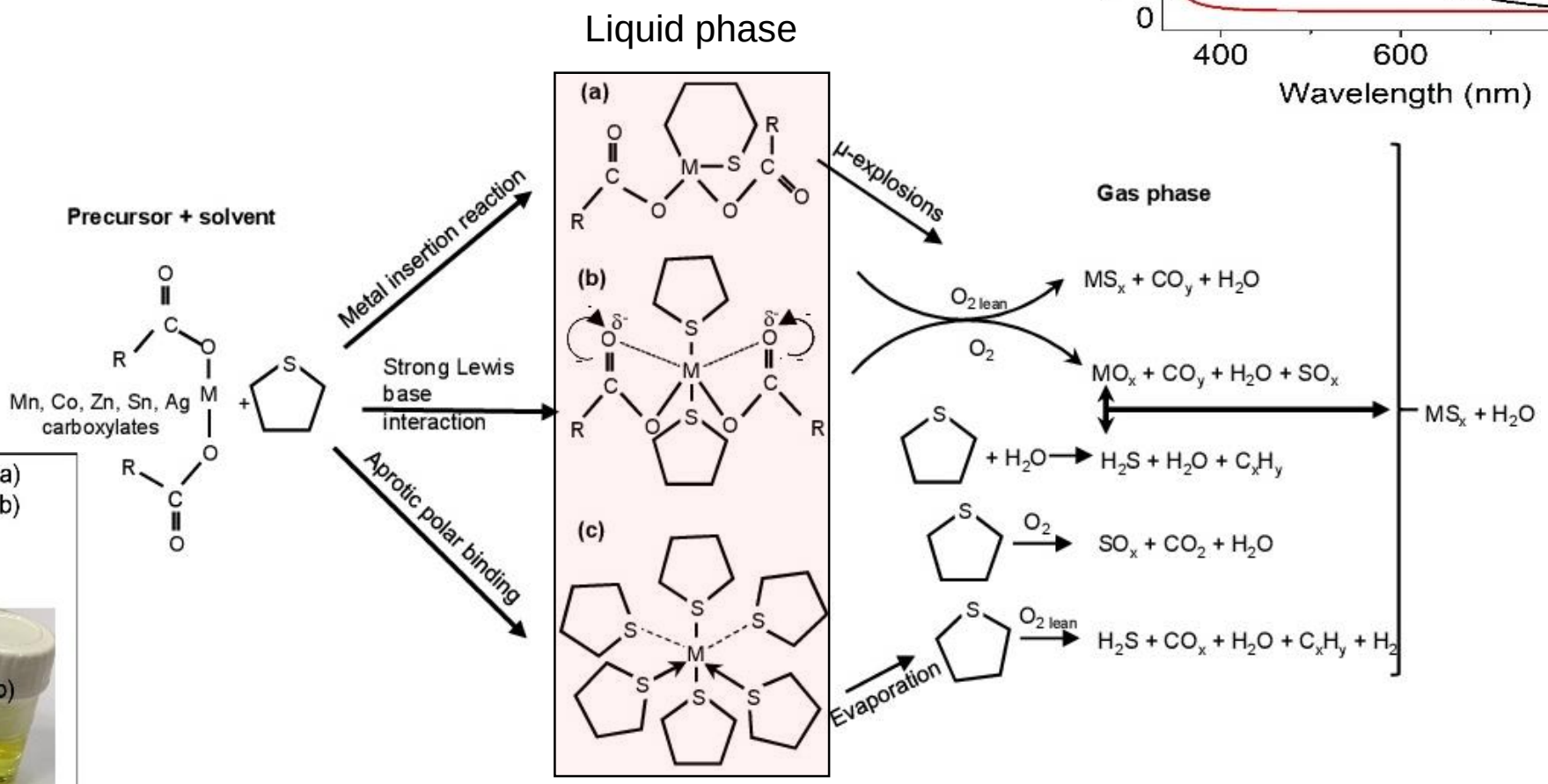
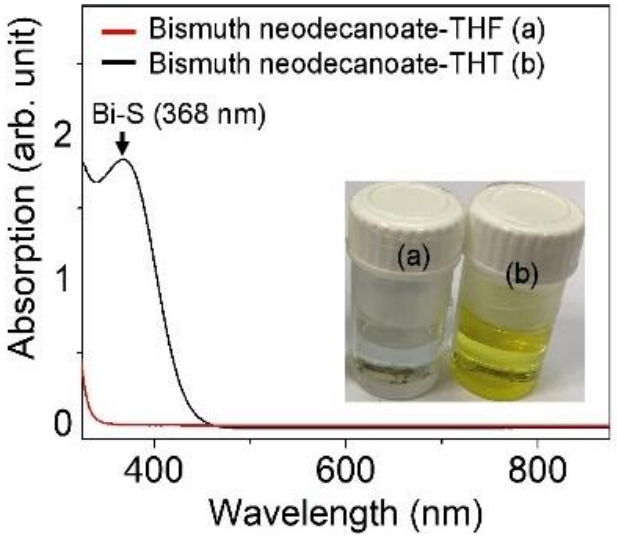
Kemmler *et al*. *Sens. and Actuators B*, **2012**,*161*(1), 740; Wang *et al*. *J. Catal.* **2013**, *302*, 10; Dreyer *et al*. *CrysEngComm*, **2016**, *18* (12), 2046; Schopf *et al*. *Transp Porous Med*, **2017**, *119*,119; Gockeln *et al. Nano Energy*, **2018**, *49*, 564

In-Situ M-S Interaction in the Liquid Phase









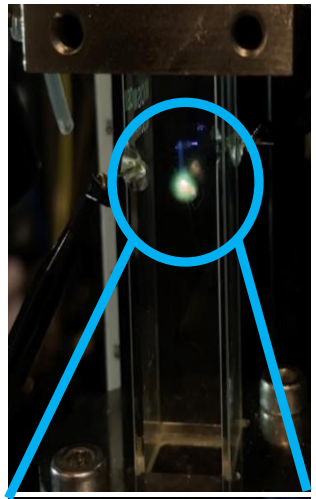
Color change of the precursor-solvent mixture: M-S coordination

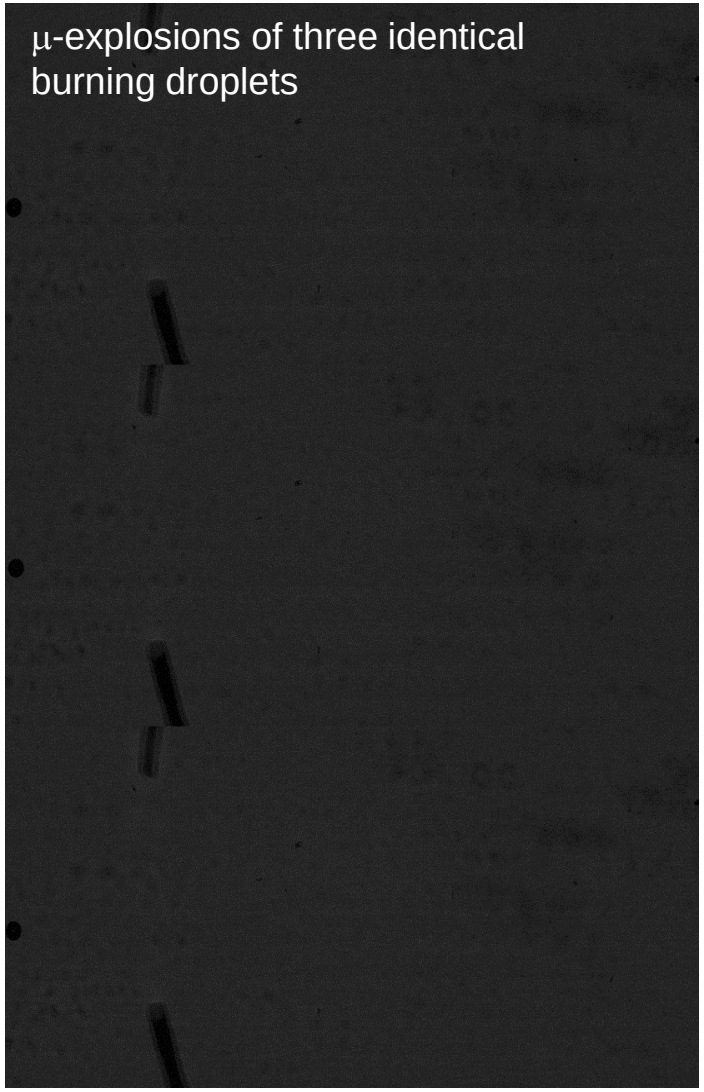
Pokhrel et al. *Adv. Mater*. **2023**, https://doi.org/10.1002/adma.202211104

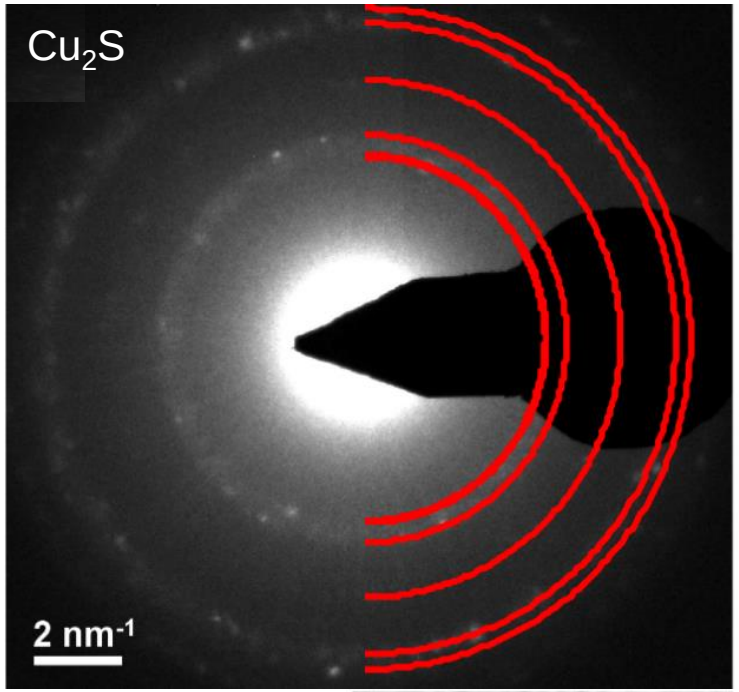
Single Droplet Combustion: THT+ Copper Naphthenate

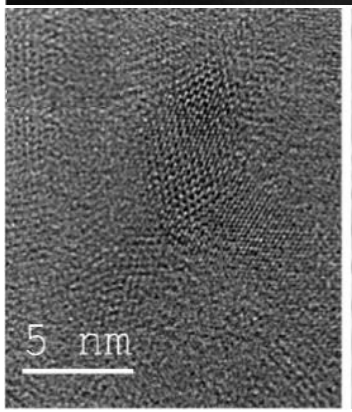
- Centered downward trajectory of the droplet in an enclosed cuvette
- Droplet combustion at the electrode spark

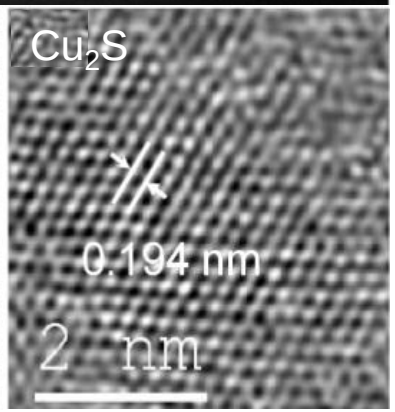
Can we apply this knowledge in the reactive spray?



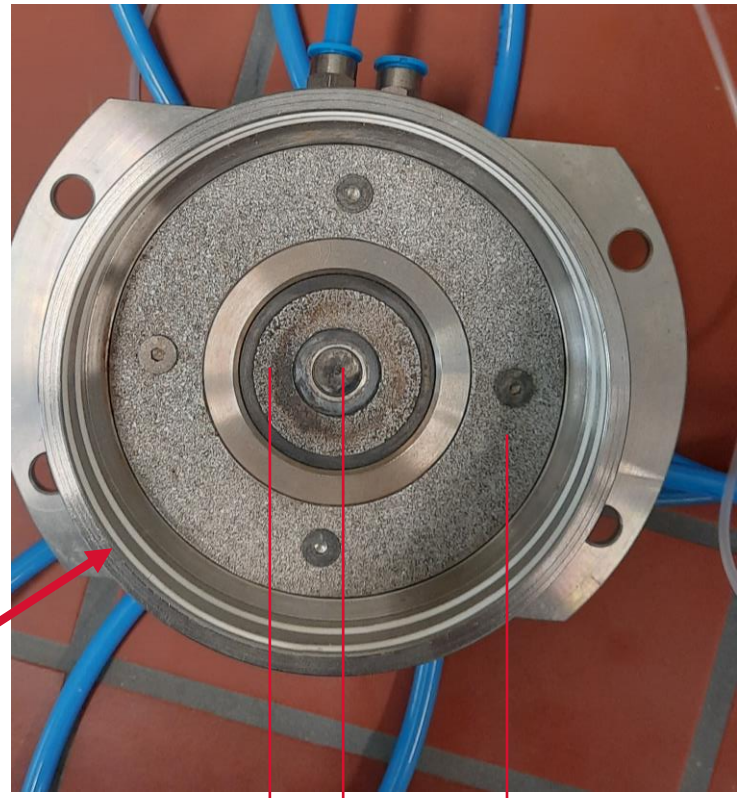








Enclosed Flame Reactors for Metal Sulfide Particle Synthesis



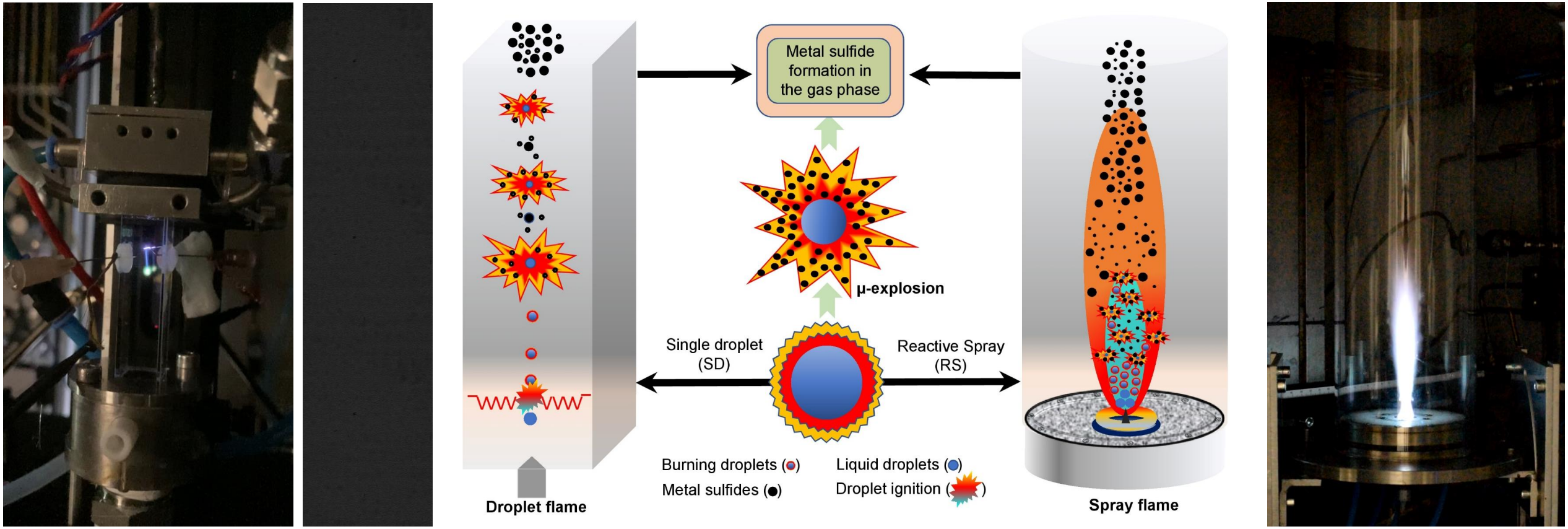
feed

N_2 co-flow base plate

Premixed gas flow

- Flame enclosing tube Length = 25-30 cm
- Tube diameter =10 cm
- large N_2 co-flow (100-400L/min)
- Particle deposition on the reactor wall is negligible

Metal Sulfide Particle Formation Pathways



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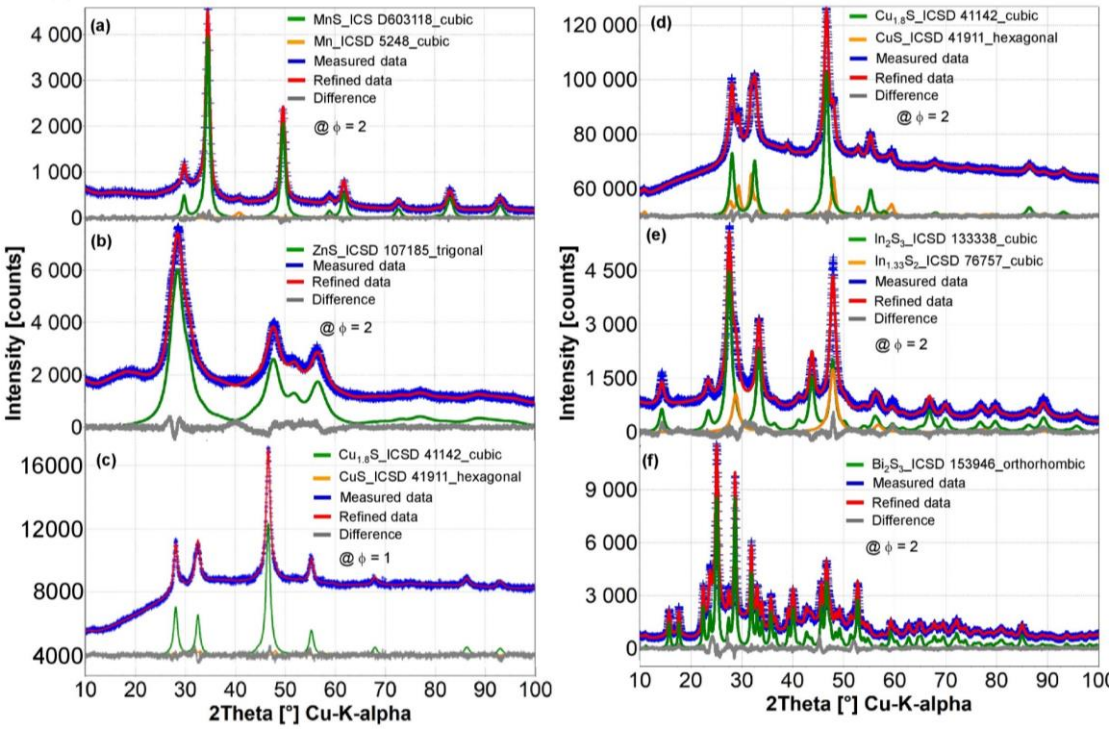
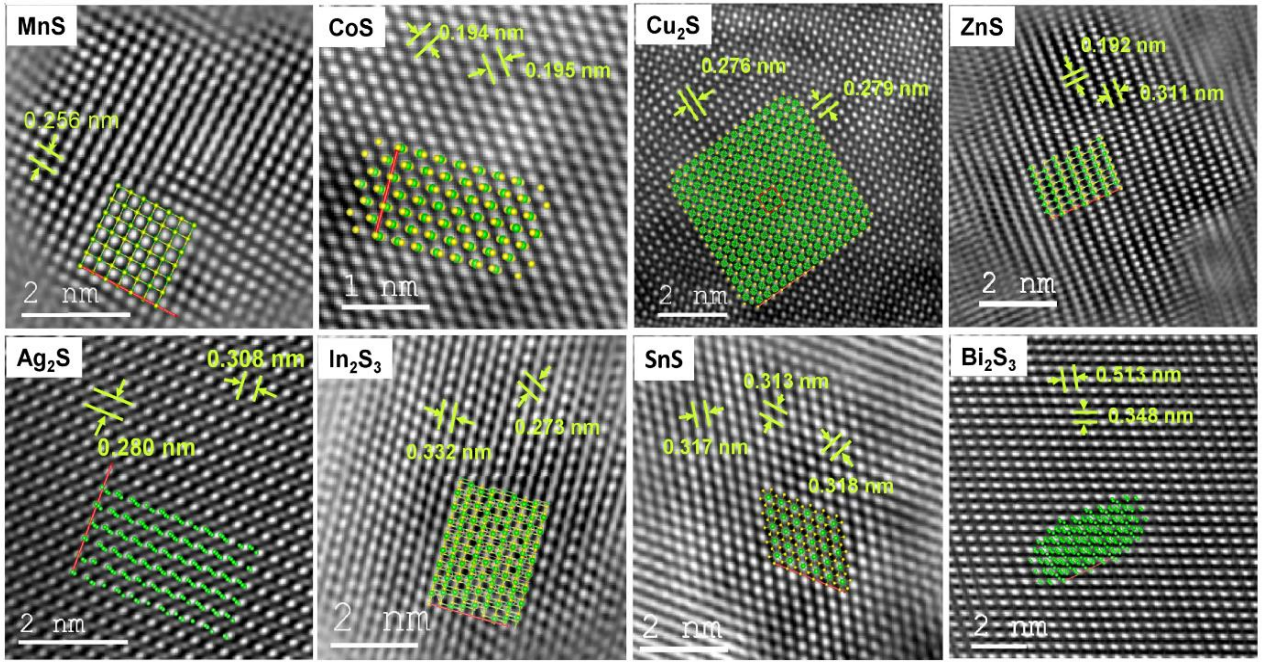
Fourier-Filtered Images: Matching Metal Sulfide Structures





- Lattice distances (from XRD and TEM) matches i.e. formation of phase pure metal sulfides; Highly crystalline particles

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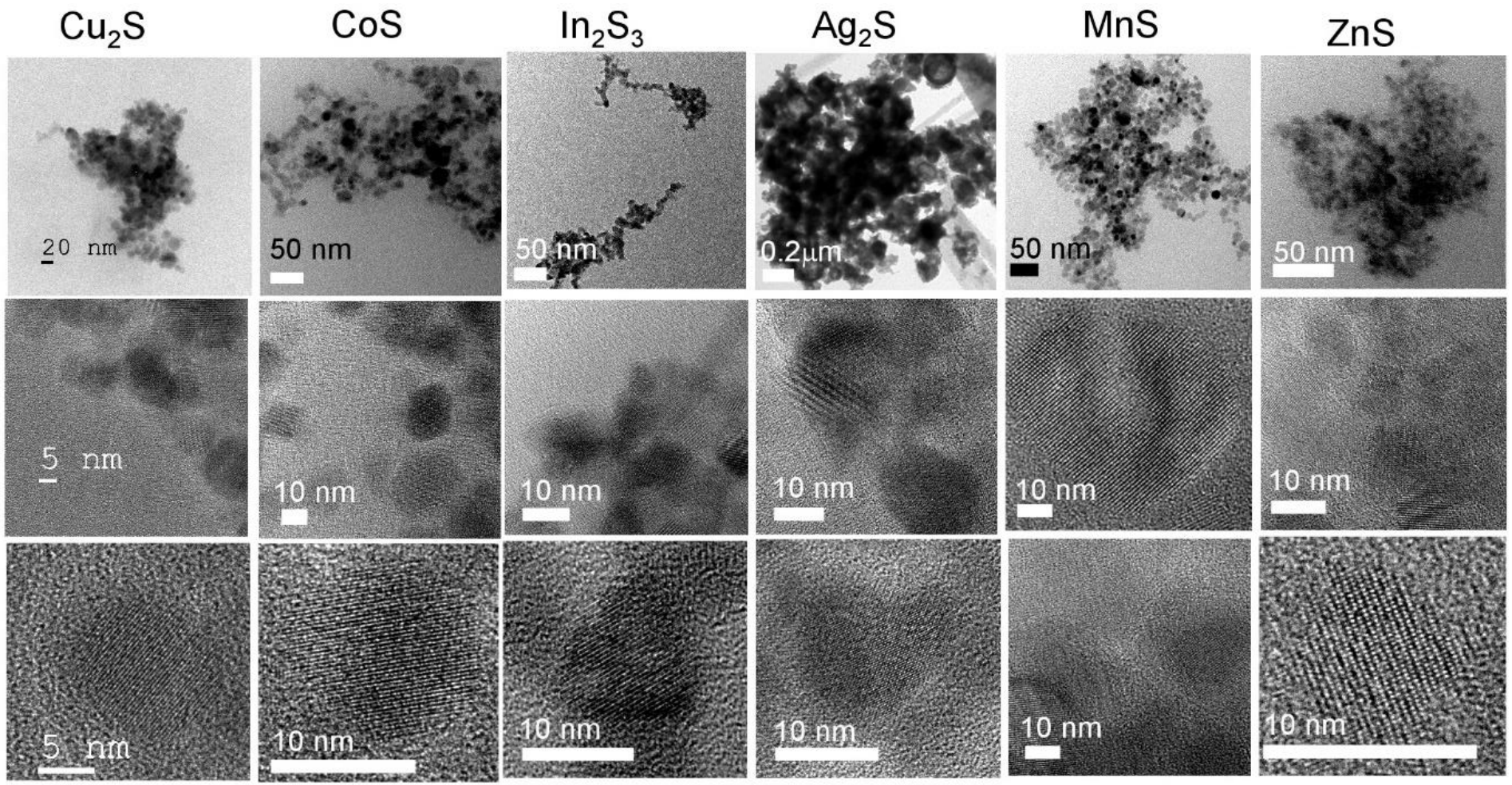
Morphology of Metal Sulfides Obtianed in O_2-Lean Atmosphere



- Particles look similar to flame-made oxides
- Agglomerated particles
- Agglomerate size vary

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Acknowledgement

European Research Council

Now our sulfides are ready for further investigations!!!
Looking for EU project participation
Delivery 1g/ batch (Highly crystalline, surface area is ~ 70-140 m^2/g)

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Thank You