How does the crystal structure influence the final composition of the Fe-Au alloy nanoparticles generated via pulsed laser ablation in liquids?

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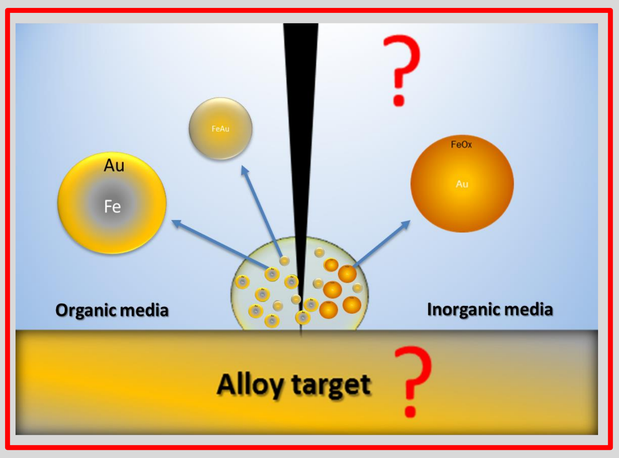
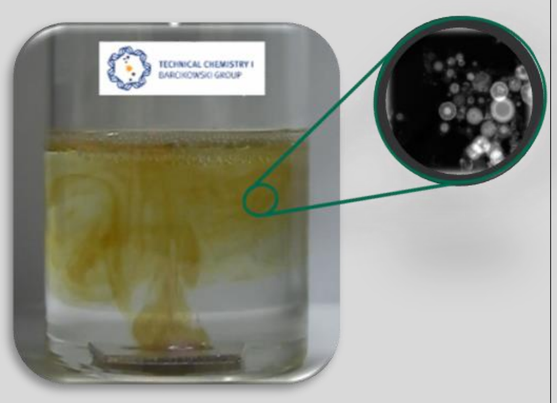
1. Motivation



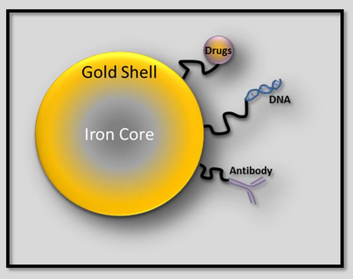
Understanding basic mechanism of nanoparticles (NPs) formation



NPs synthesis via PLAL

[1]

Dual MRI / Optical imaging



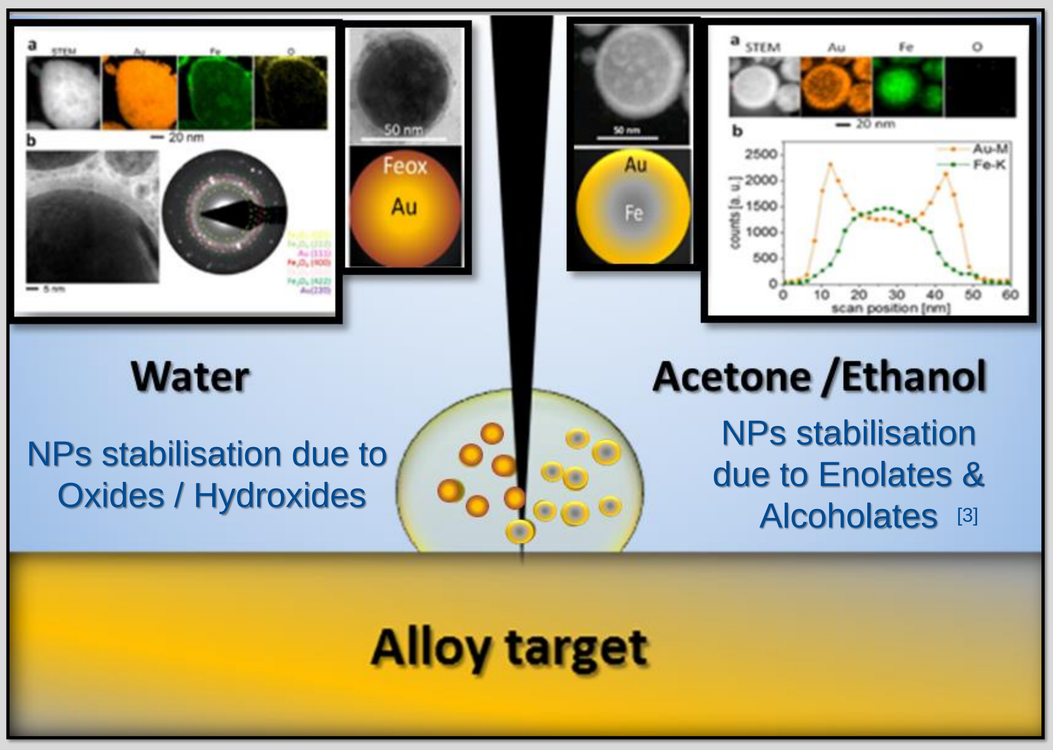
[4]

Bioconjugation via thiol-gold chemistry

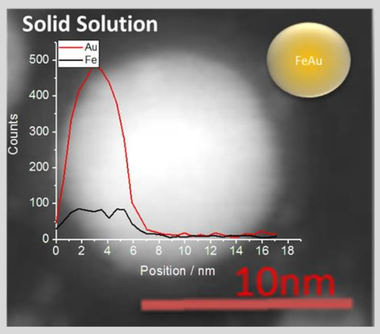
Possible Application

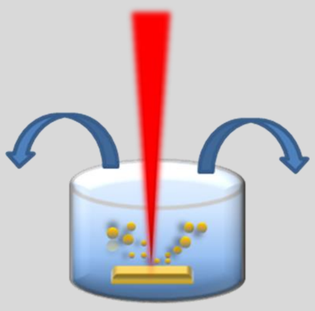
2. Liquid environment influence on the structure of Fe@Au NPs:

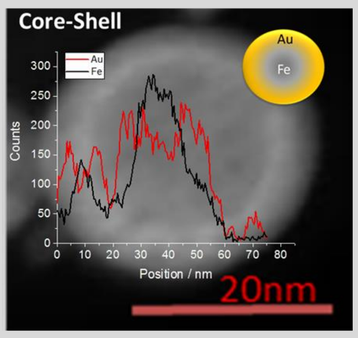
[2]



3. Characterization of NPs via EDX & TEM

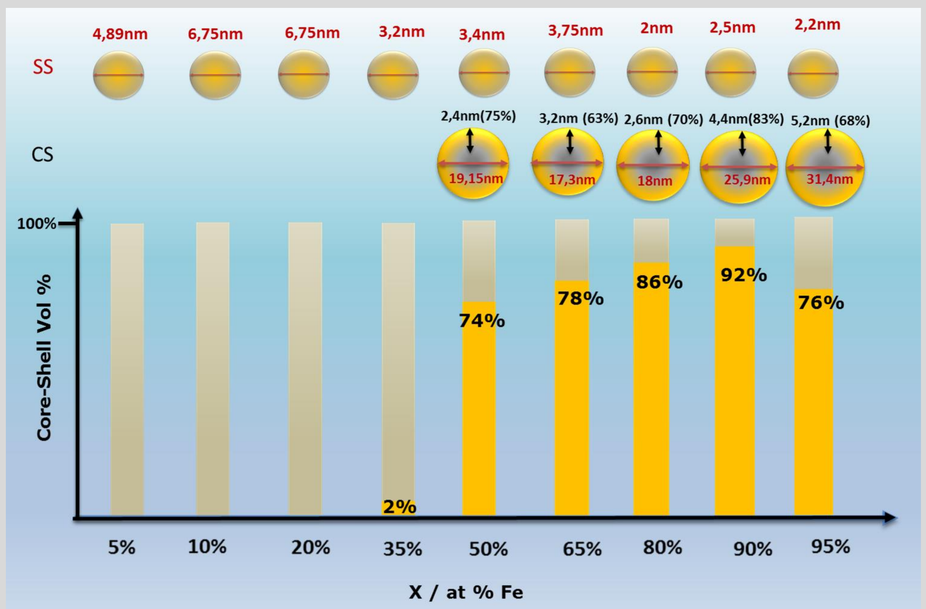




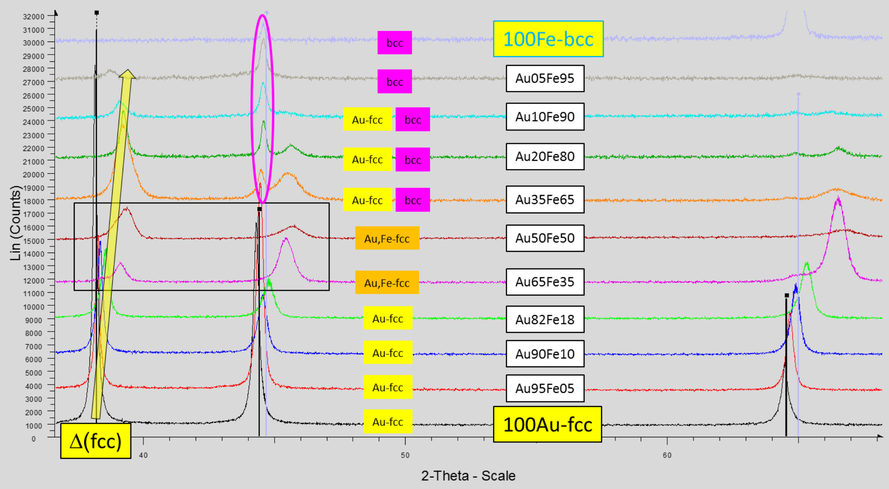


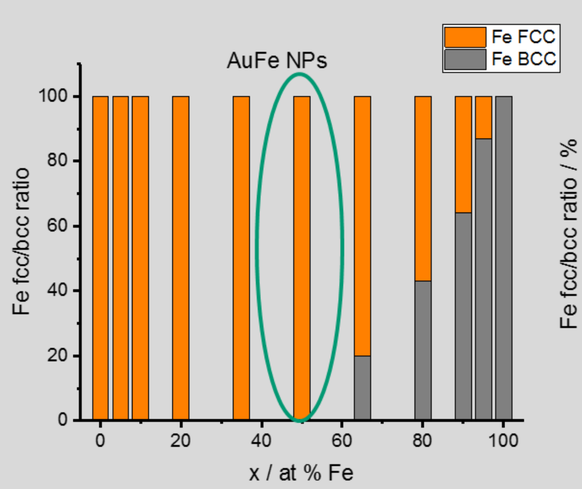
NPs generated from Gold rich alloy targets produce only Homogenous NPs. Average size of those NPs lies below 10nm

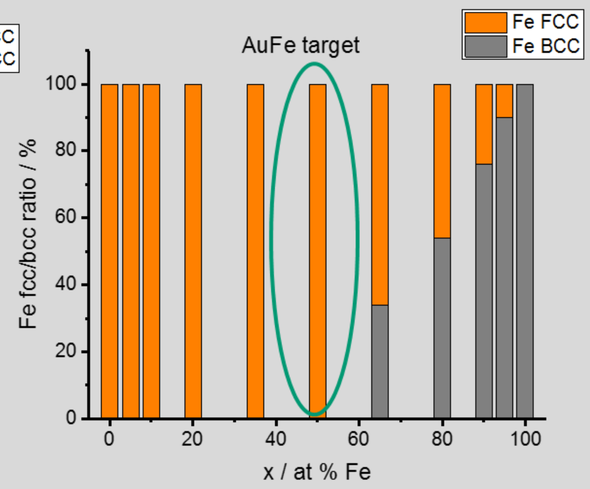
Core shell NPs have average size above 10nm, and are generated from target with higher amounts of Iron in alloy target.



4. Crystal structure influence on the structure of Fe@Au NPs:







- Only Fe fcc for Au rich targets (SS NPs)
- Fe bcc favor phase segregation (CS NPs)

- No Fe bcc for $Au_{50}Fe_{50}$ why CS?

size effect ←→ molar fraction

Summary

- Iron core and Gold shell NP is favored in organic media, synthetized from alloy target with higher Iron content.
- The smallest possible Core-Shell NP have diameter around 13nm. NPs below 10nm favor Homogenous structure.
- Fe bcc crystal structure favors phase segregation, whereas Fe fcc favor solid solution NPs.

References

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[4] JH. Lee, Y.M. Huh, J.W. Seo, J.T. Jang, H.T. Song, S. Kim, EJ. Cho, H.G. Yoon, J.S.Suh, J. Cheon, Nat. Med. 2006, 13, 95

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