MgO nanoparticles obtained by Pulsed Laser Ablation in Liquid

A study on fabrication versatility aiming different applications

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Coimbra

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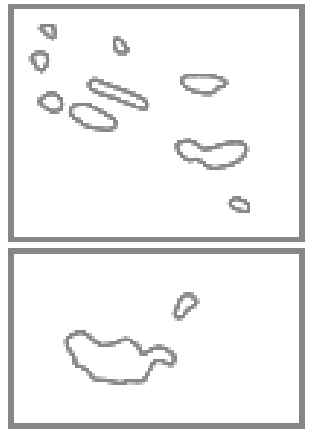
The Team



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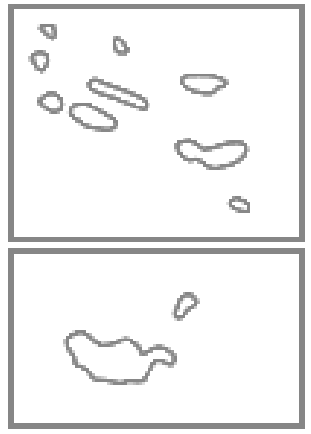

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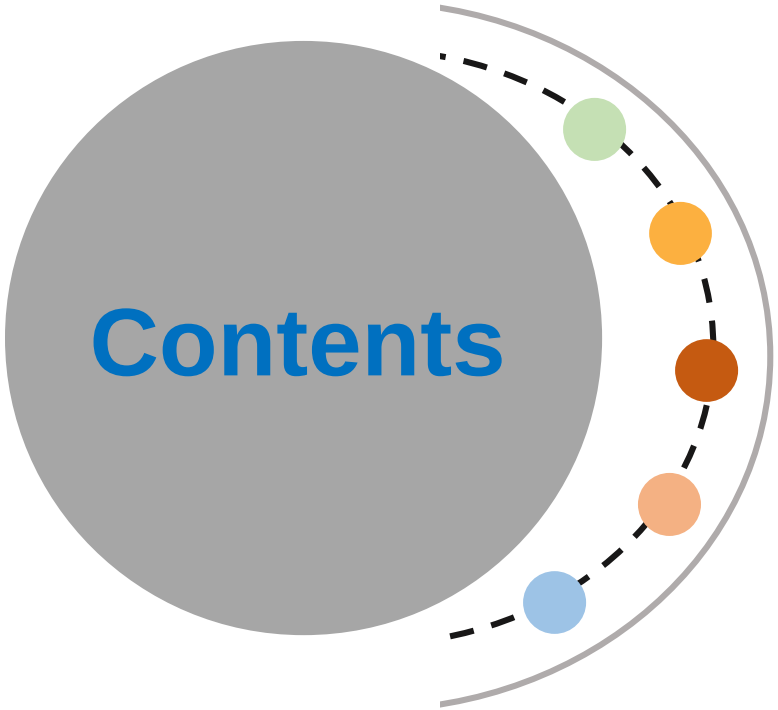
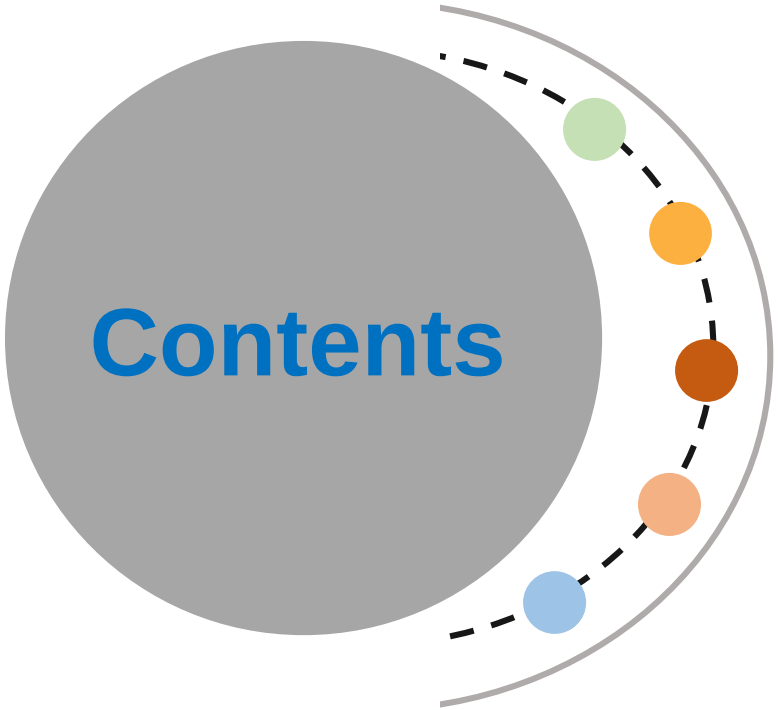
Today's Presentation



1. Motivation
2. The goal
3. Experimental
4. Results & Discussion
5. Conclusion

Today's Presentation



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Motivation

Nanoparticles are defined as solid colloidal particles ranging in **size** from **1 to 100 nm**.

Available in different shapes and sizes.

Ag, Au and **Cu** nanoparticles are used in stretchable textiles and wearable solar textiles, to **food packaging** where **nano-silver** is widely used.

Motivation

Metal oxide nanoparticles such as Magnesia or **magnesium oxide** (MgO) have properties which open a wide range of applications in industry.

Adsorbents for toxic chemicals

catalysis

dye removal found in textile wastewater

antibacterial and anticancer activity

Motivation

Nanoparticles can be synthesized by a variety of techniques:

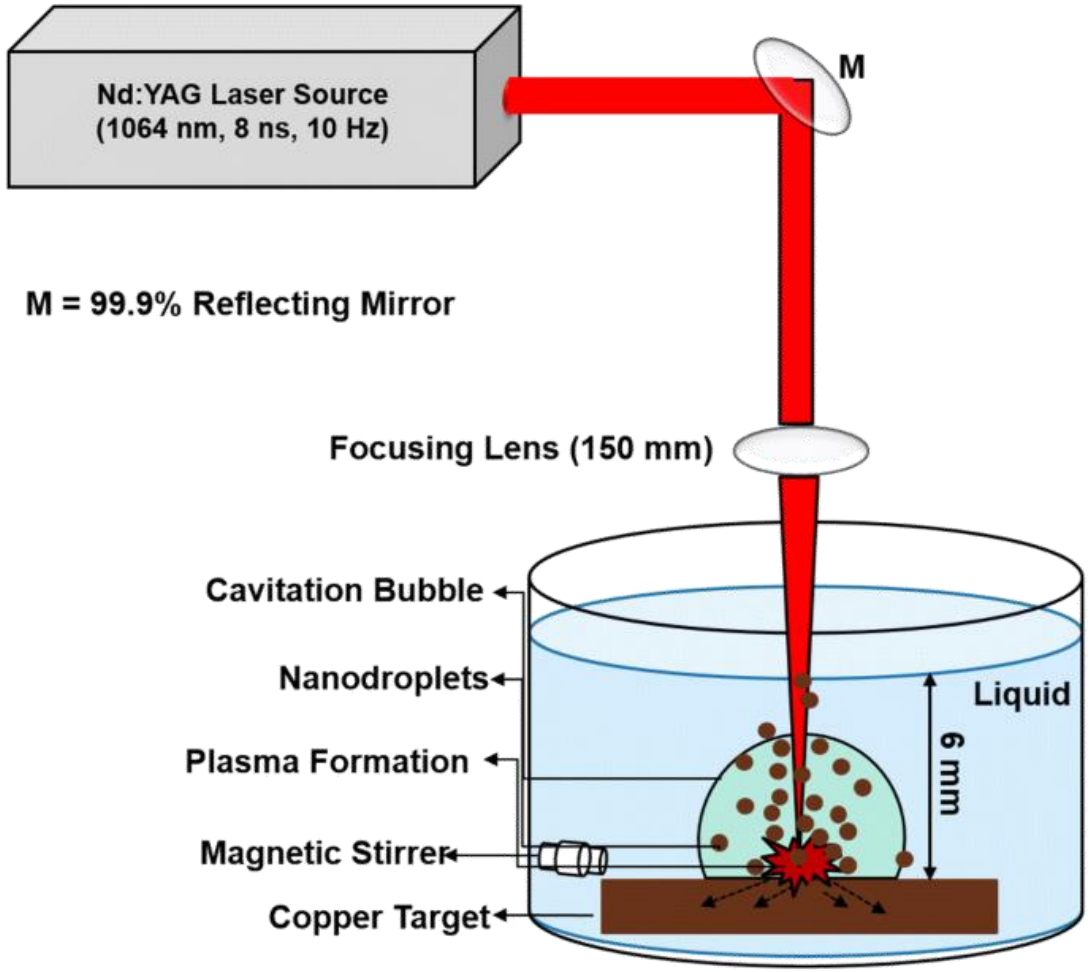
chemical reactions; thermal evaporation; sol-gel; chemical vapor deposition and hydrothermal

Laser ablation in liquid

simple “green” synthetic process for preparing nanoparticles however it remains a challenging topic of investigation

Motivation

Pulsed Laser Ablation



Rawat, R., Tiwari, A., Arun, N. et al. Synthesis of CuO hollow nanoparticles using laser ablation: effect of fluence and solvents. Appl. Phys. A 126, 226 (2020).

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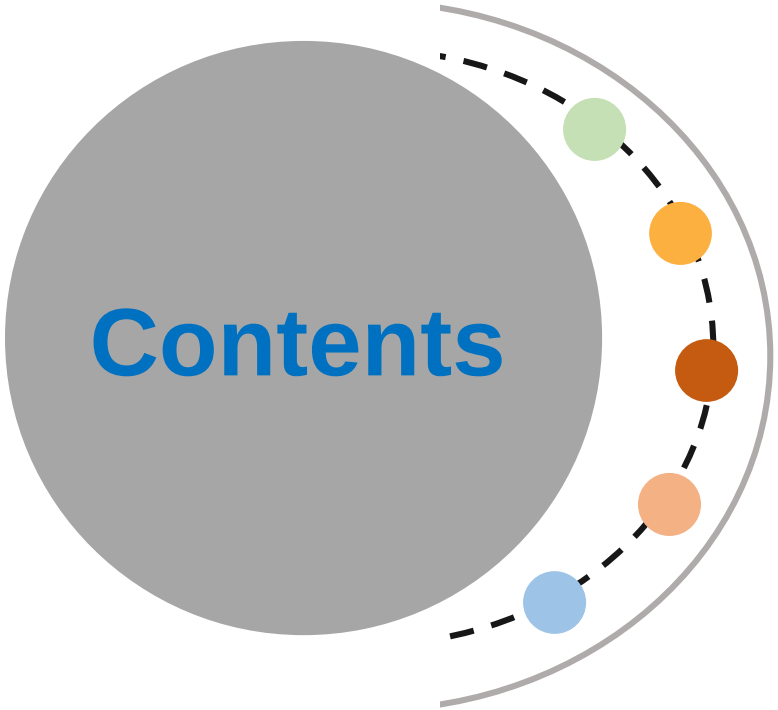

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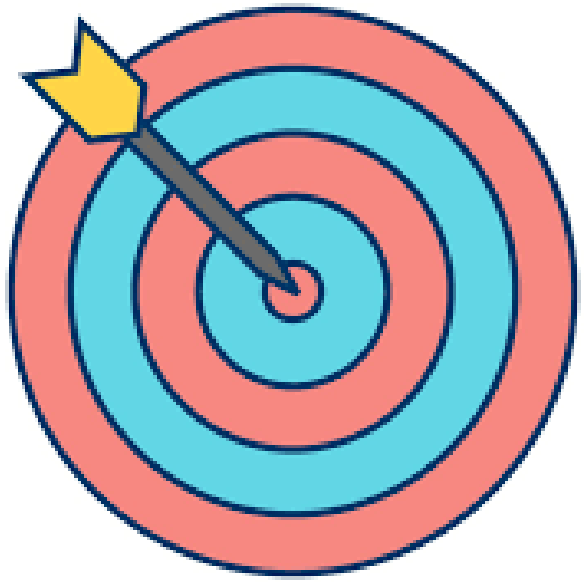
The goal



Influence of the liquid medium and the laser energy are explored with respect to nanoparticle composition and morphology.

We report a facile method to synthesis MgO/ $Mg(OH)_2$ nanoparticles by pulsed laser ablation in liquid.

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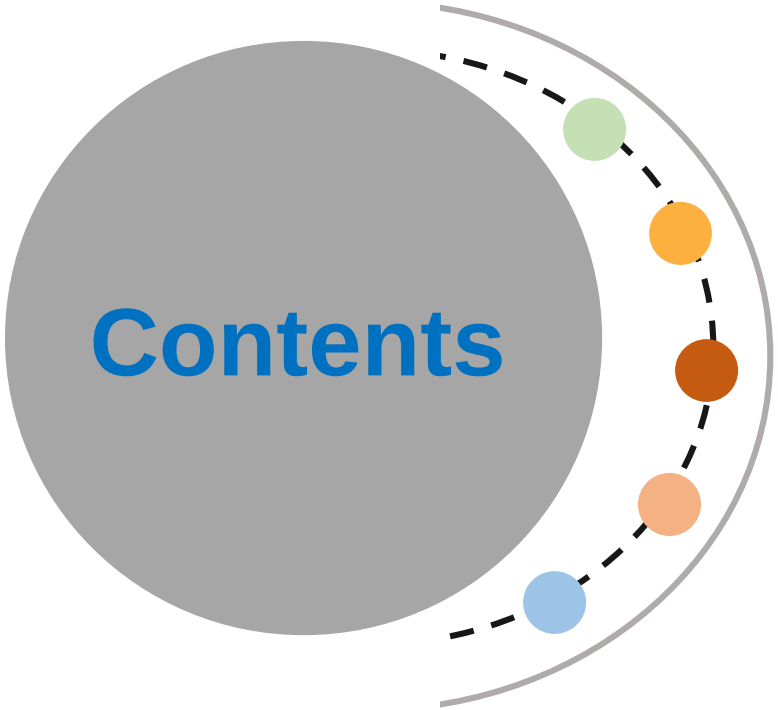

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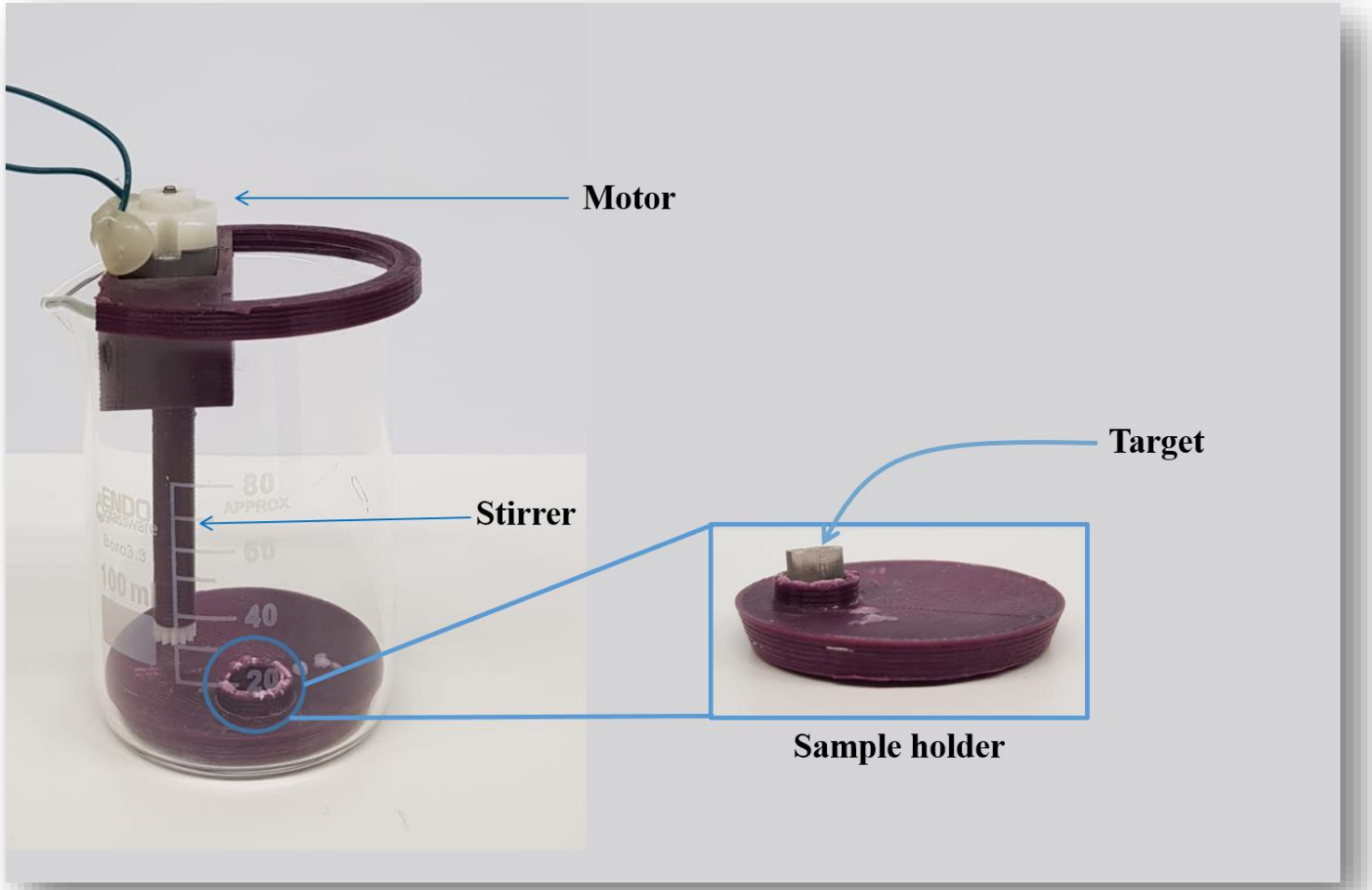
Experimental

SAMPLE FABRICATION



Experimental

SAMPLE FABRICATION

Liquid media	Laser speed (mm/s)	Energy (W.s/m)
DW + SDS (0.025 mol/L)	2.5	1400
	5.0	1200
	10.0	600
	20.0	300
Ethanol (99%)	2.5	1400
	5.0	1200
	10.0	600
	20.0	300
Propanol (99%)	2.5	1400
	5.0	1200
	10.0	600
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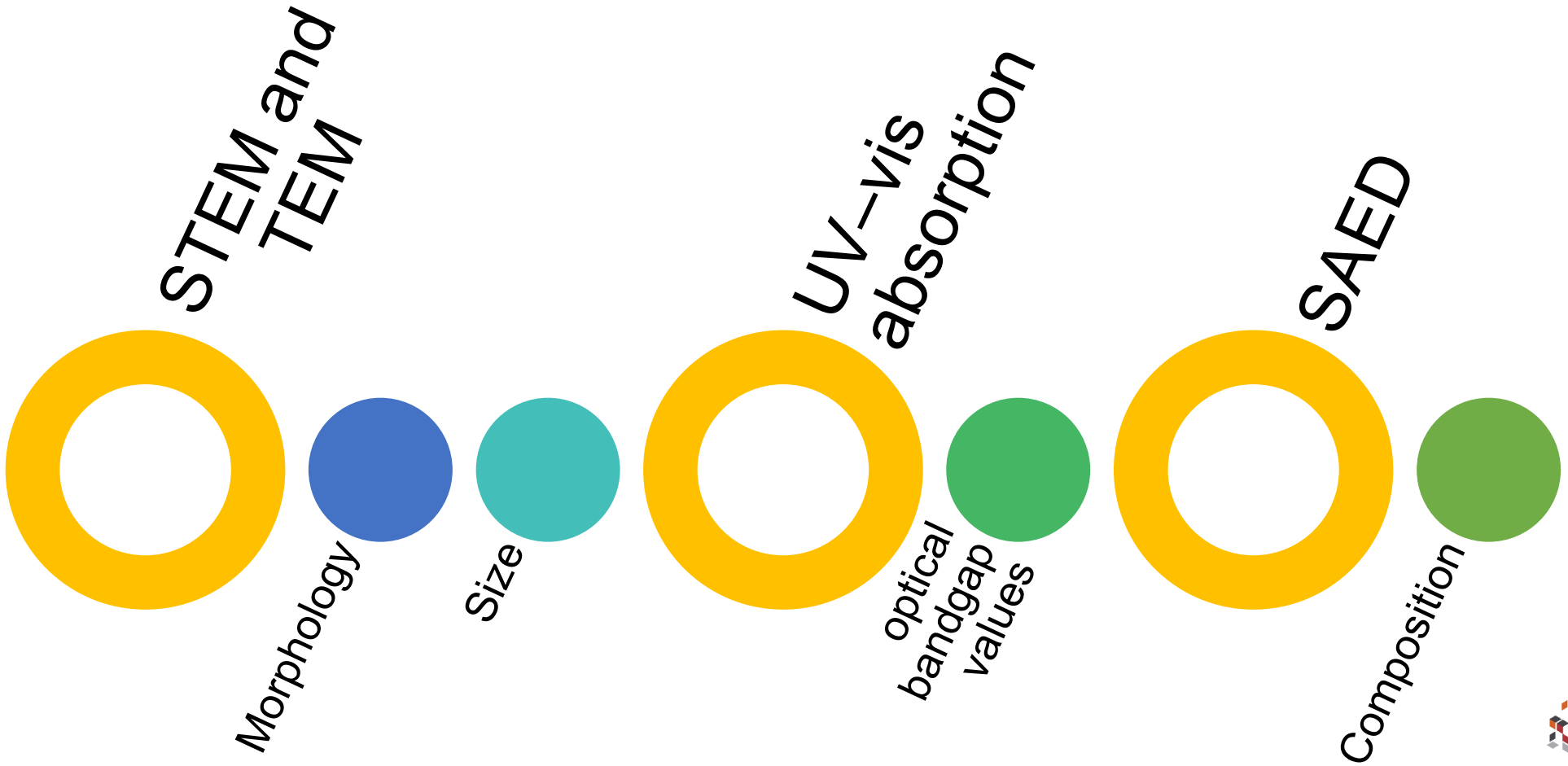
Experimental

Sample Characterization



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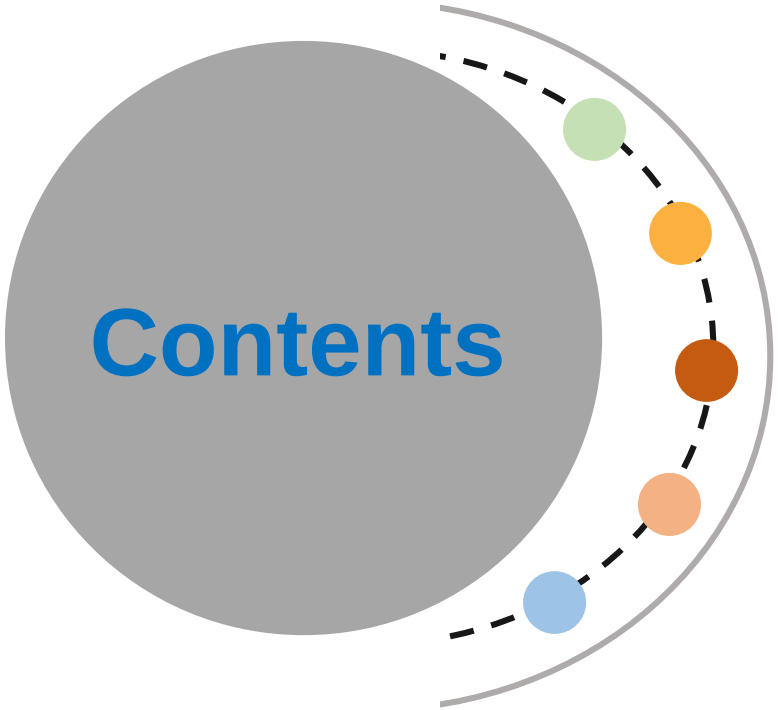

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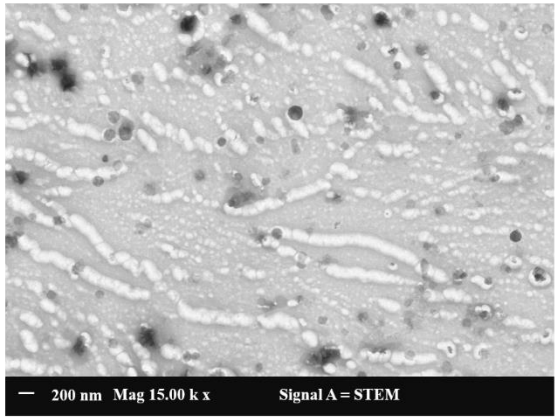
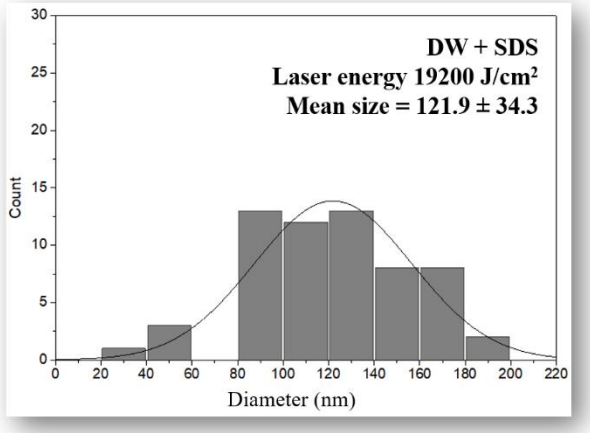
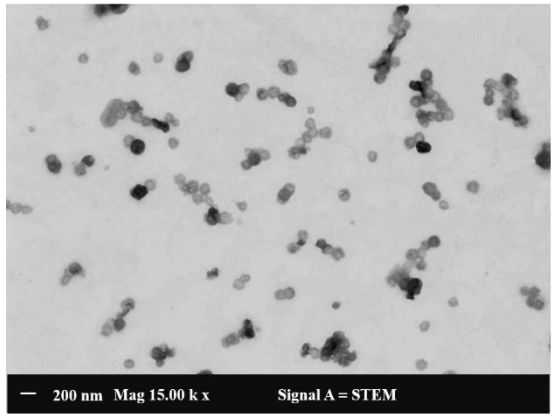
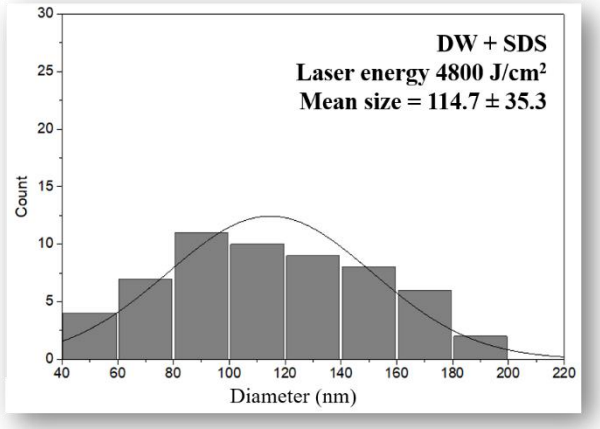
Results and discussion

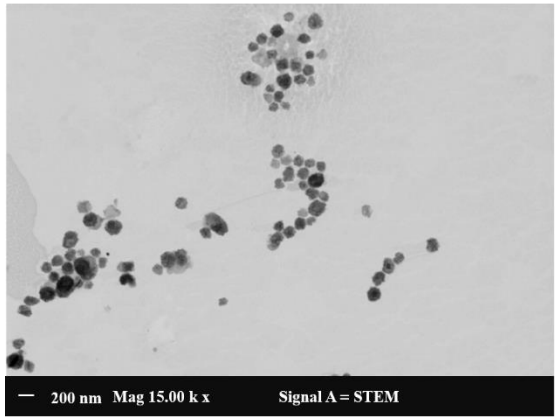
LASER ENERGY INFLUENCE

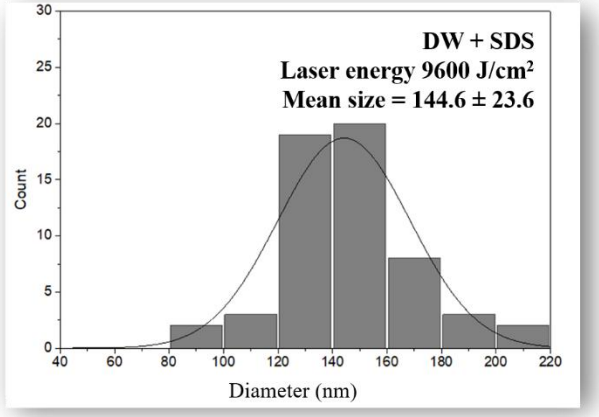


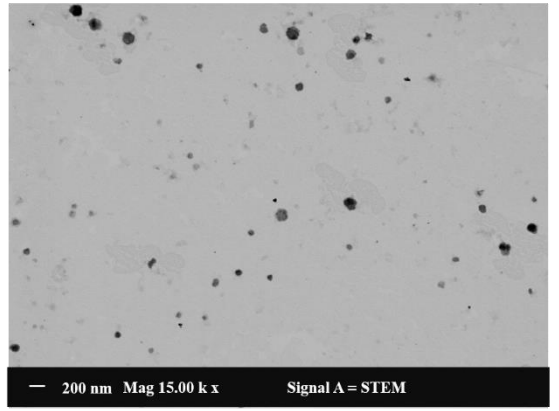


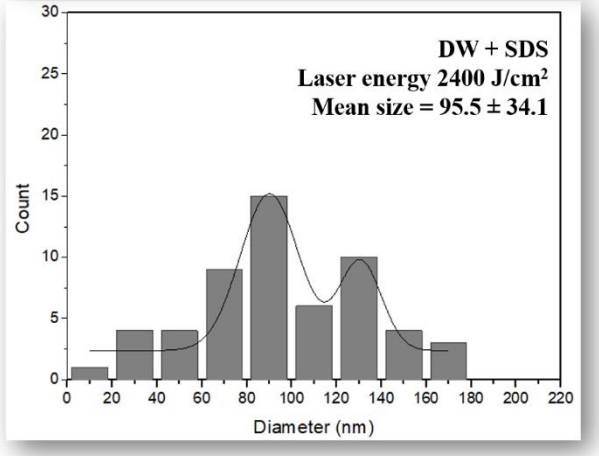






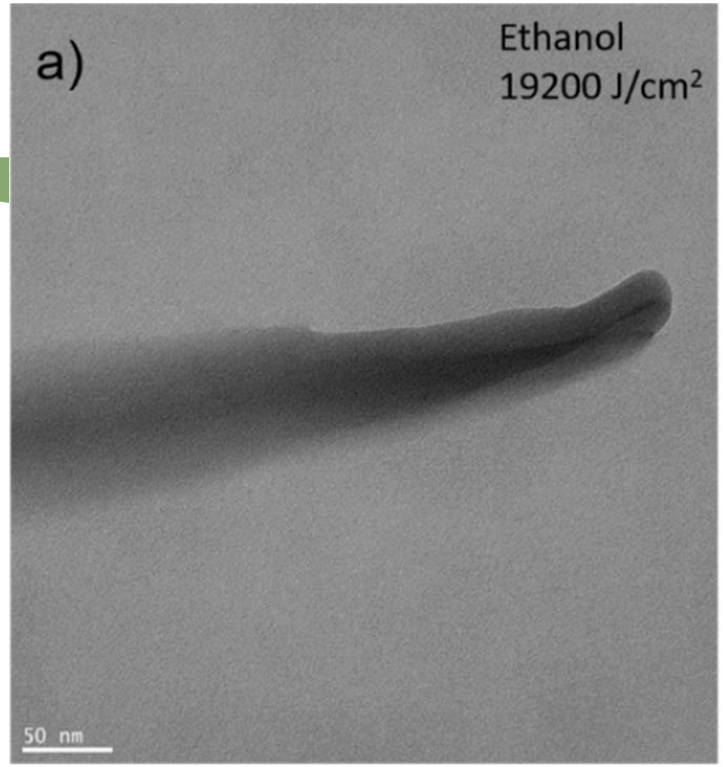






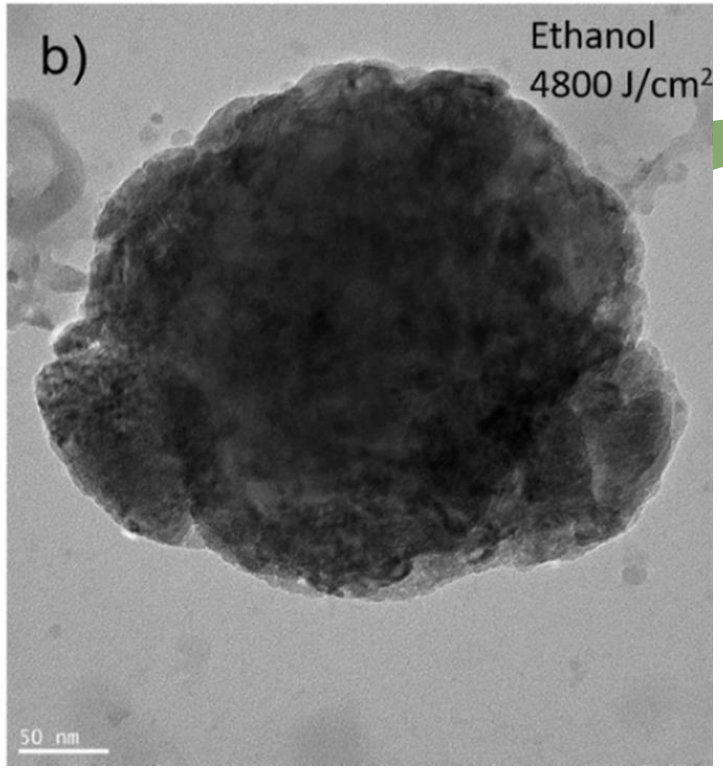
Results and discussion

MORPHOLOGY



Results

Lower laser speed

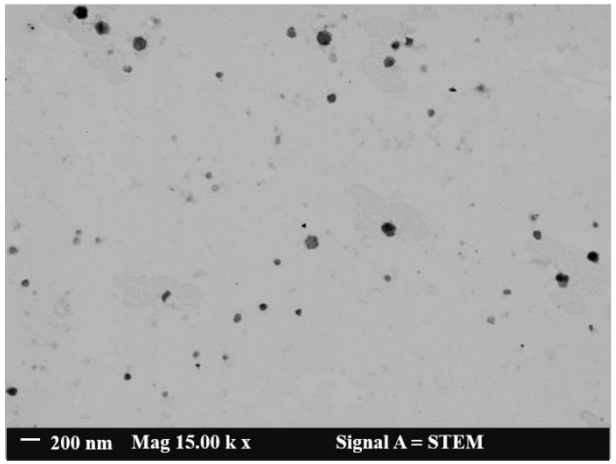


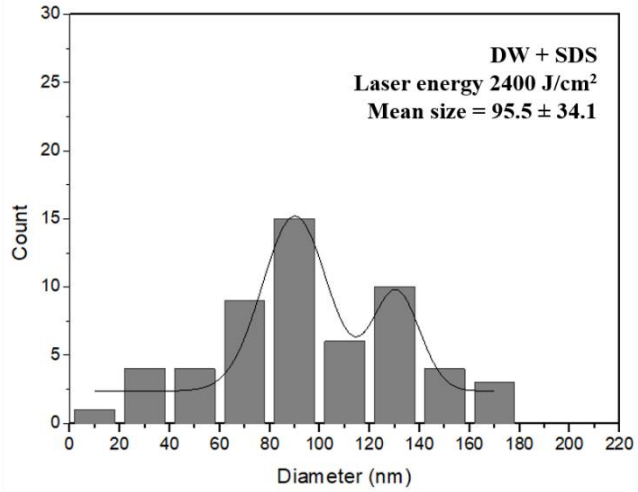
Results

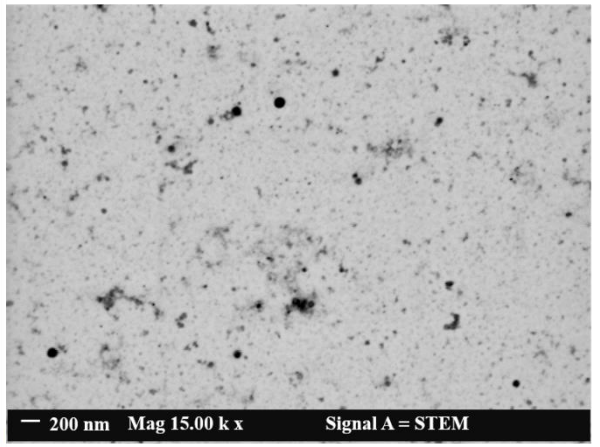
Higher laser speed

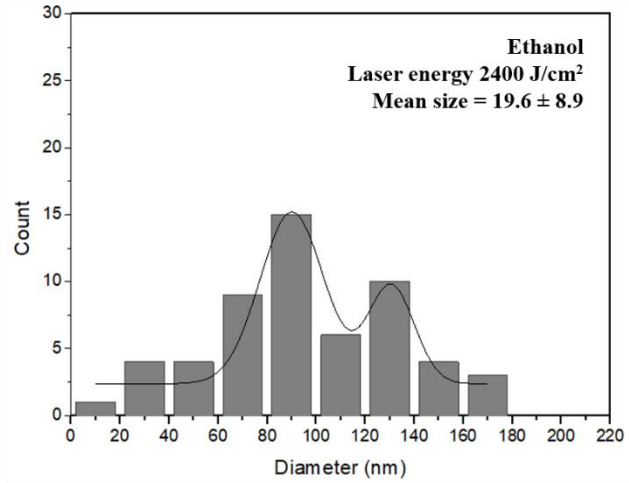
Results and discussion

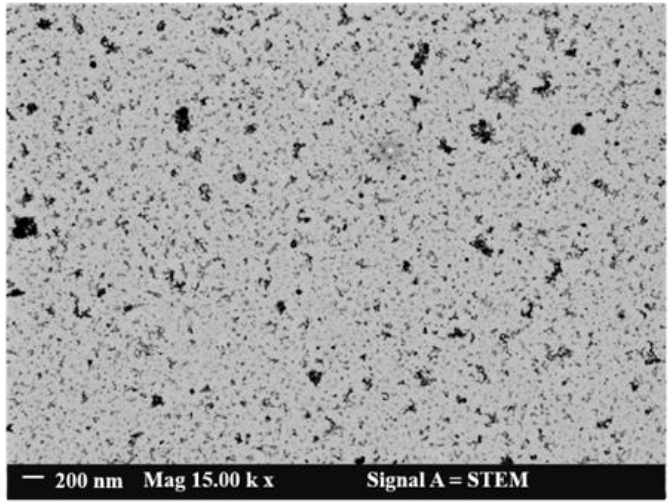
LIQUID INFLUENCE

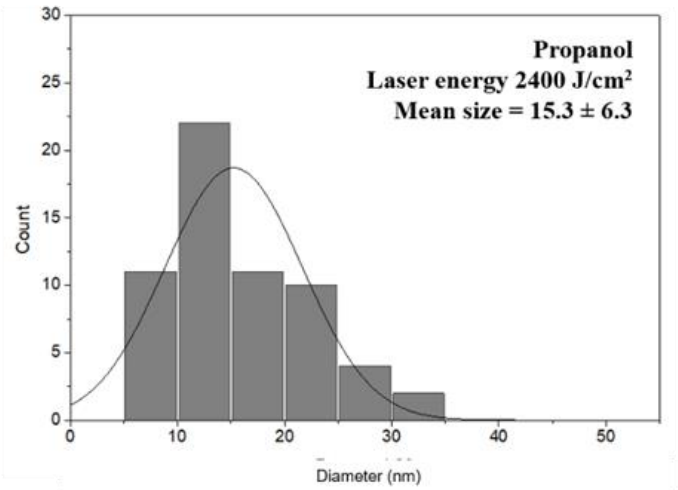






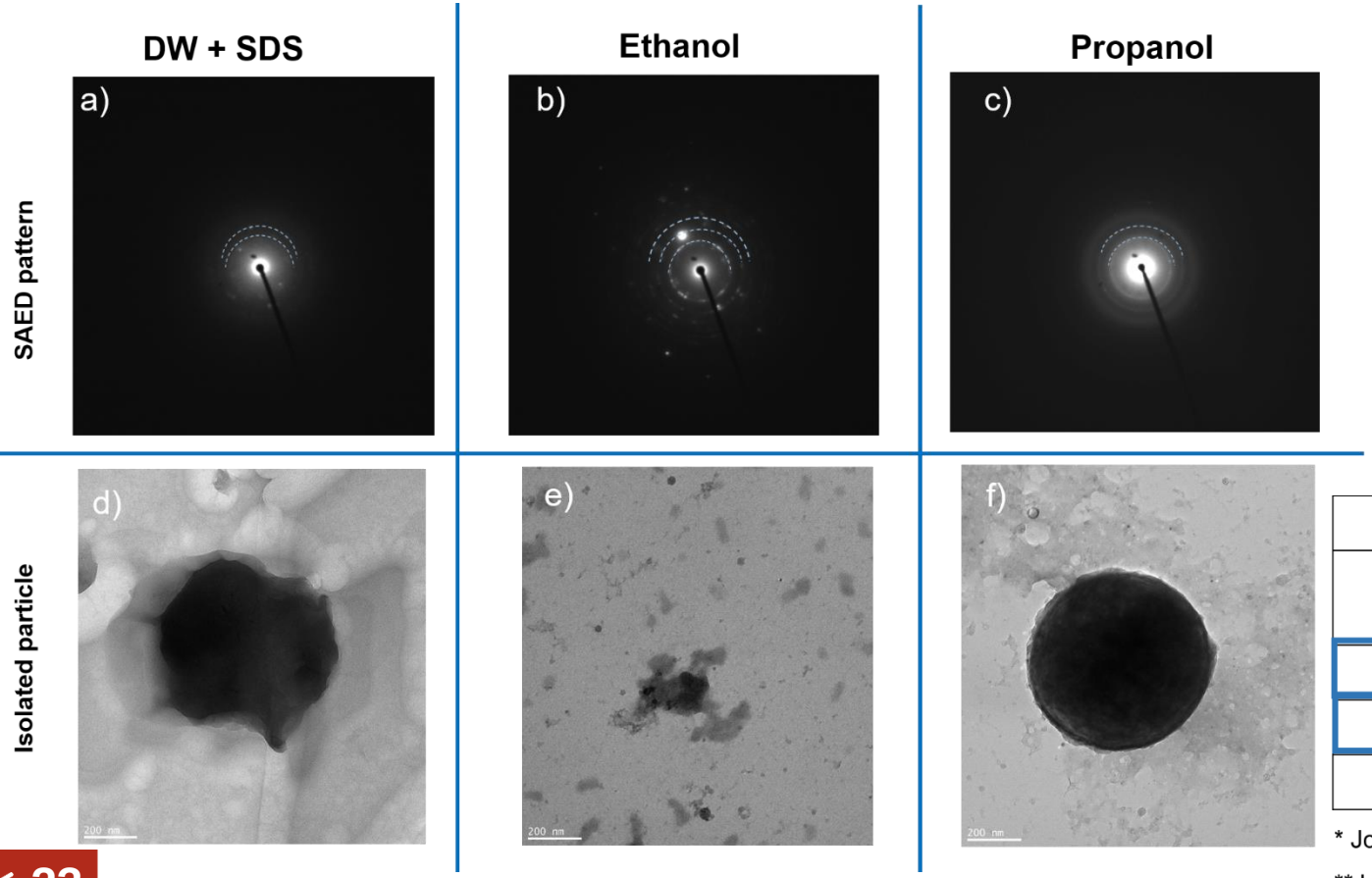






Results and discussion

COMPOSITION



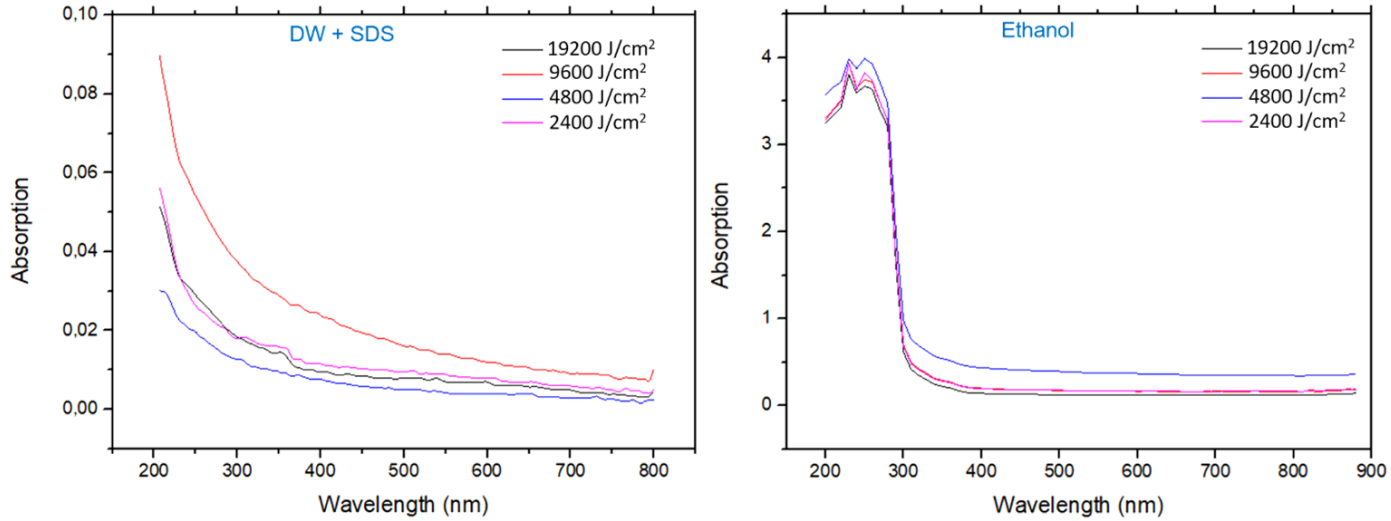
d-spacing (Å)				
DW + SDS	Ethanol	Propanol	* MgO (k h l)	** $Mg(OH)_2$ (k h l)
2.109	2.211	**2.184**	**2.100**	2.360
1.508	**1.525**	**1.526**	**1.490**	**1.570**
	1.255	1.311	**1.210**	**1.493**

* Jcpds 00 – 001 - 1235

**Jcpds 00 – 044 - 1482

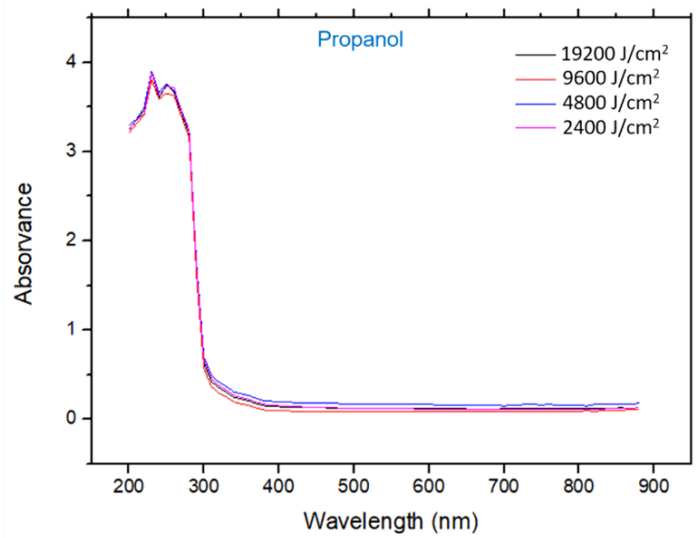
Results and discussion

UV-VIS ABSORPTION



Tauc's relation:

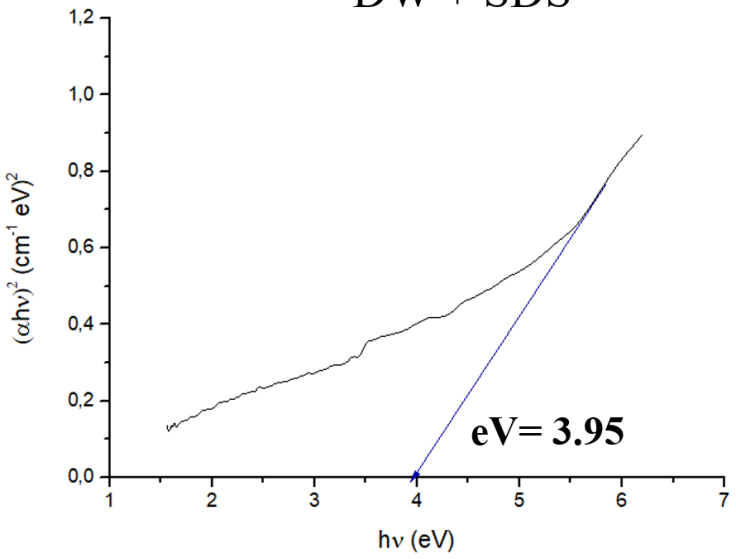
$$(\alpha h\nu)^{1/n} = A(h\nu - Eg)$$



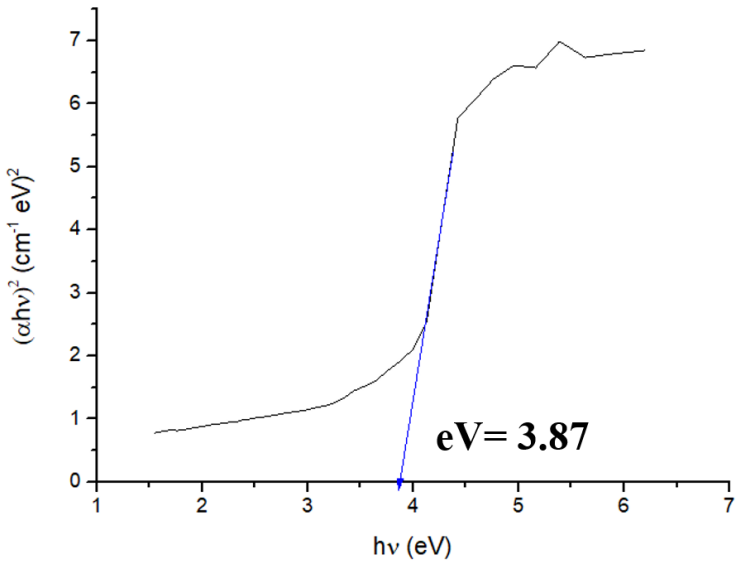
Results and discussion

BANDGAP

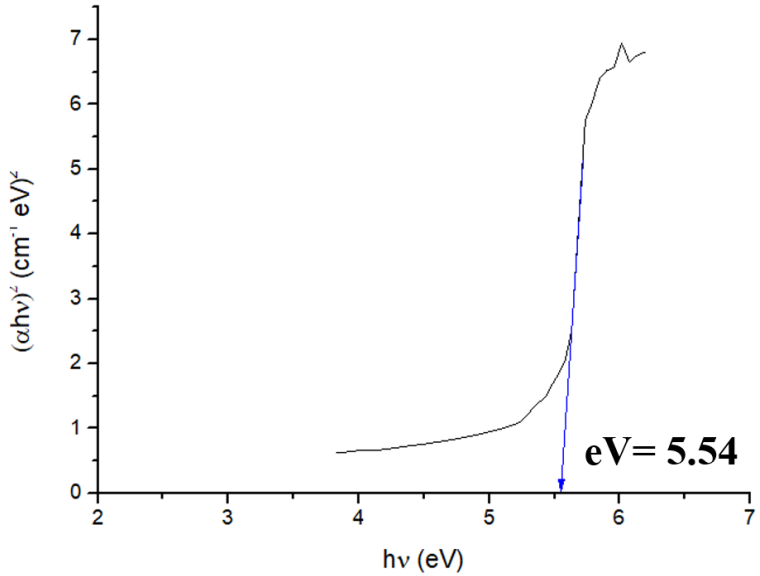
DW + SDS



Ethanol



Propanol



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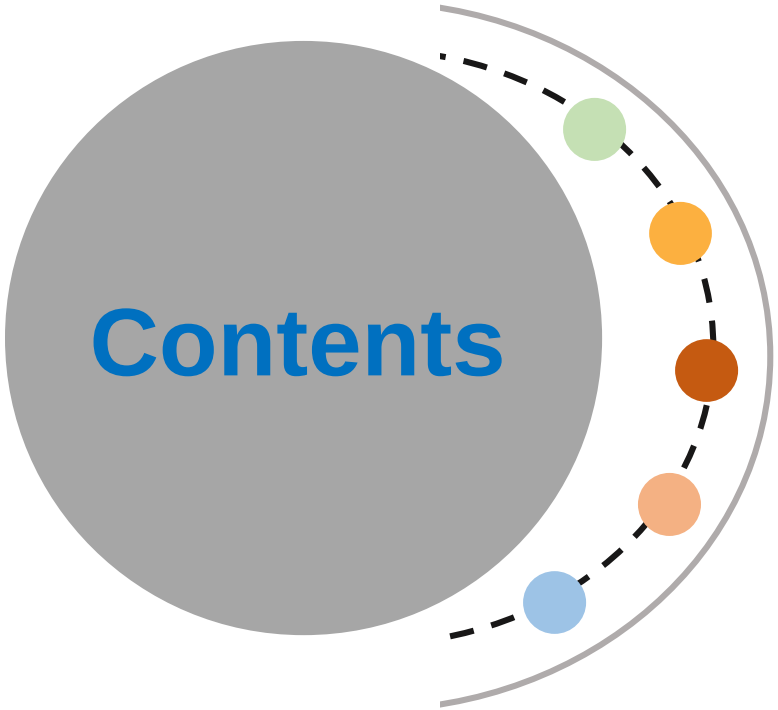

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Conclusion

Pulse Laser ablation is a potential for the nanoparticle fabrication.

Using a pure Mg target, Magnesium oxides and magnesium hydroxide were obtained in this study using DW+SDS and propanol and liquid media.

Significantly smaller particles were obtained when using ethanol and propanol, having 16.7 and 15.3 nm respectively, as compared to DW+SDS.

Acknowledgments

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Thank you for your attention!!

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A study on fabrication versatility aiming different applications

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