### Multifunctional Polymer Dispersant for Graphene/AgNWs Nanocomposites

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#### Abstract

We developed a multifunctional polymer dispersant incorporating styrene sulfonate, disulfide-based methacrylate, and potential urethane-forming protected isocyanate groups. The newly developed dispersant facilitated the stable aqueous co-dispersion of graphene and AgNWs while improving the oxidation resistance and conductivity. Structural analysis by NMR and IR confirmed the successful synthesis of the polymer, while TEM imaging revealed graphene-coated AgNWs for enhanced oxidation resistance and improved electrical performance.

This novel nanocomposite exhibits significant potential for advanced electrodes and sensors, overcoming the challenges in graphene/AgNW systems. The proposed approach paves the way for the development of stable, high-performance materials for next-generation electronic devices.

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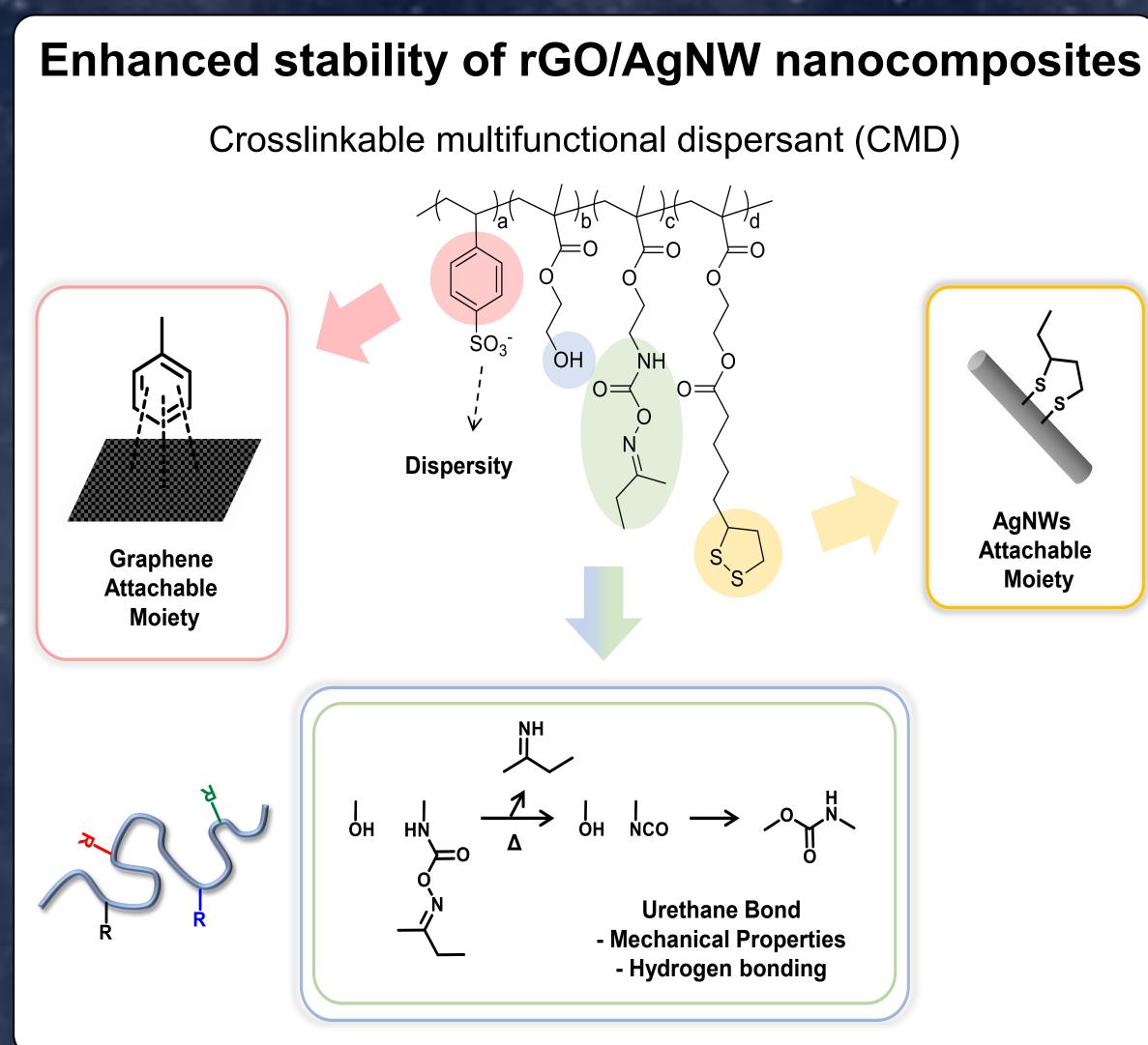
**Improved Oxidation Stability** 

# Introduction Chemical exfoliation of graphite **Graphite Functionalization** Multifunctional Polymer Graphene/AgNWs hybrid nanocomposites **Poor Contact**

Graphene

coating

#### Research Goal

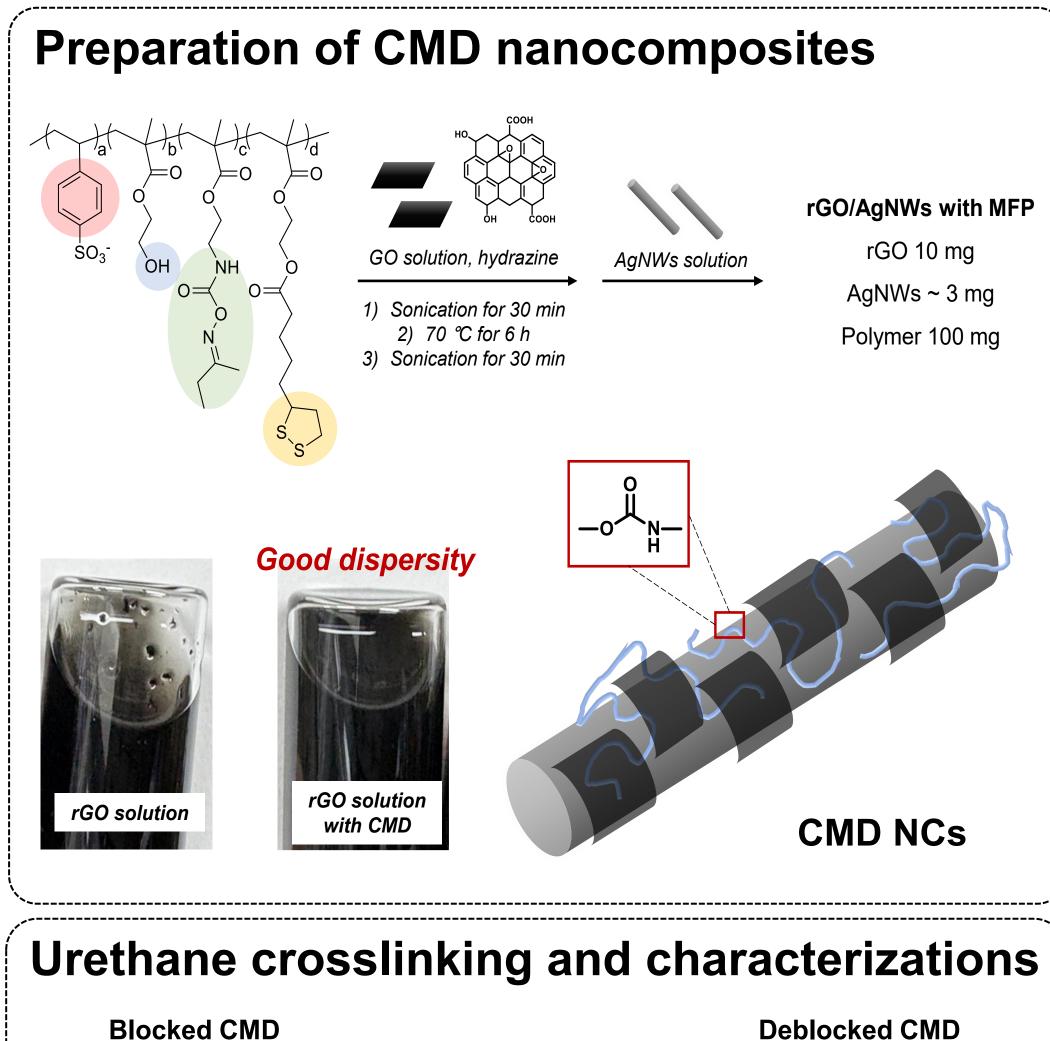


### Result & Discussion

**AgNW** 

**Electrical Conductivity** 

**Flexibility** 



**Low Oxidation Stability** 

**High Contact Resistance** 

### **Blocked CMD Deblocking reaction** of NCO under heat **Urethane bond** formation → ¹H NMR > FT-IR Urethane 1 **Blocked CMD Deblocked CMD** 1500 2000 3000 2500 Wavenumber (cm<sup>-1</sup>)

## **TEM images of CMD NCs** > rGO with CMD > AgNWs > CMD NCs 100 nm 100 nm

#### Sensor applications for Parkinson's disease diagnosis

> Detection of L-DOPA, Uric Acid (UA), Tyrosine (Ty)

L-DOPA <del>-----</del> 2.5 μМ -0.2 0.0 0.2 0.4 0.4 0.6 0.2 Different modifications E/V (Ag/AgCI) E/V (Ag/AgCI) 150 L-DOPA — 5.0 μN  $I_{na} = 284.29x - 24.21$ 100  $R^2 = 0.9937$ **(**40) E/V (Ag/AgCI) E/V (Ag/AgCI) Scan rate  $^{1/2}$  (V·s<sup>-1</sup>) $^{1/2}$ 150 UA ----- 5.0 μM  $I_{\text{pa}} = 279.54x - 18.02$ \_\_\_\_20.0  $I_{\rm na} = 281.08x - 22.52$ 

 $R^2$ = 0.9937

Scan rate<sup>1/2</sup> (V·s<sup>-1</sup>)<sup>1/2</sup>

<del>----</del> 120.0

0.4

E/V (Ag/AgCI)

## Scan rate<sup>1/2</sup> (V·s<sup>-1</sup>)<sup>1/2</sup> Conclusions

- We synthesized a crosslinkable multifunctional dispersant, and designed graphene-attatched AgNWs nanocomposites.
- Under heating, the blocked isocyanate undergoes a deblocking reaction, leading to urethane-based crosslinking.
- The CMD NCs was applied as a sensor for Parkinson's disease, enabling effective detection of L-DOPA, UA, and Ty.

### Acknowledgement

0.5

(HA)

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0.4

0.5

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 $R^2 = 0.9903$ 

0.3

100

50