



WEARPLEX Gamma Workshop: Future Reduced Graphene Oxide ink developments



Azadeh Motealleh¹

Siamak Eqtesadi¹, Nikola Perinka², Rune Wendelbo¹

¹ LayerOne AS, Norway

² BCMaterials, Spain

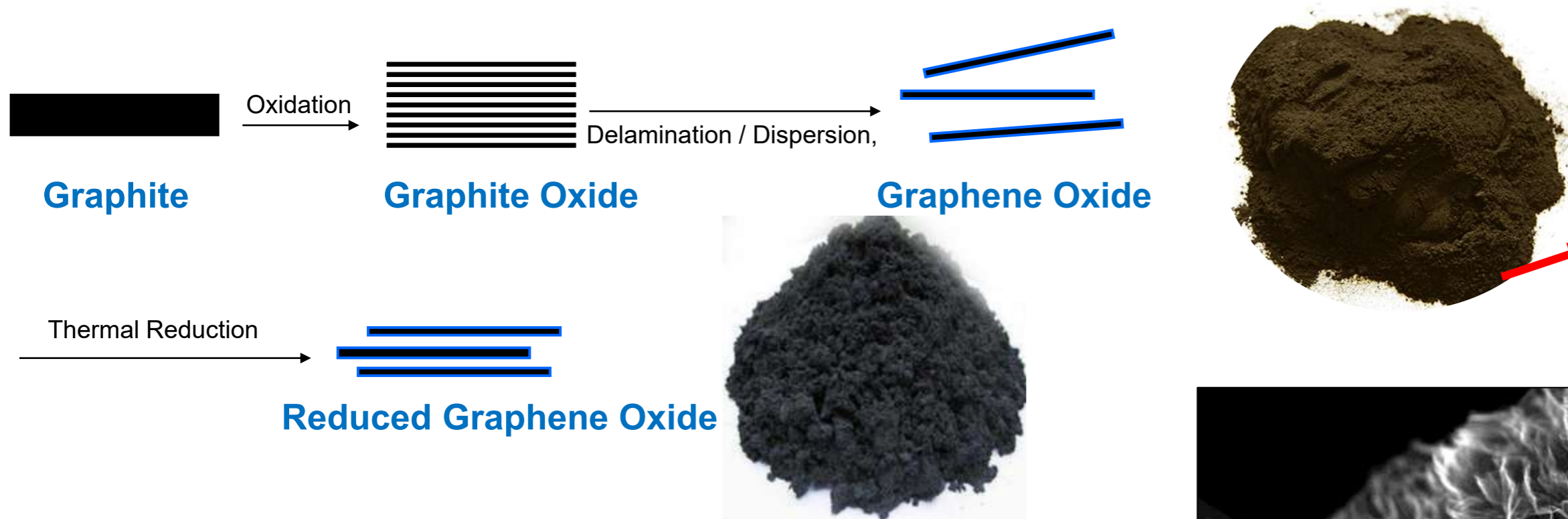
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Introduction

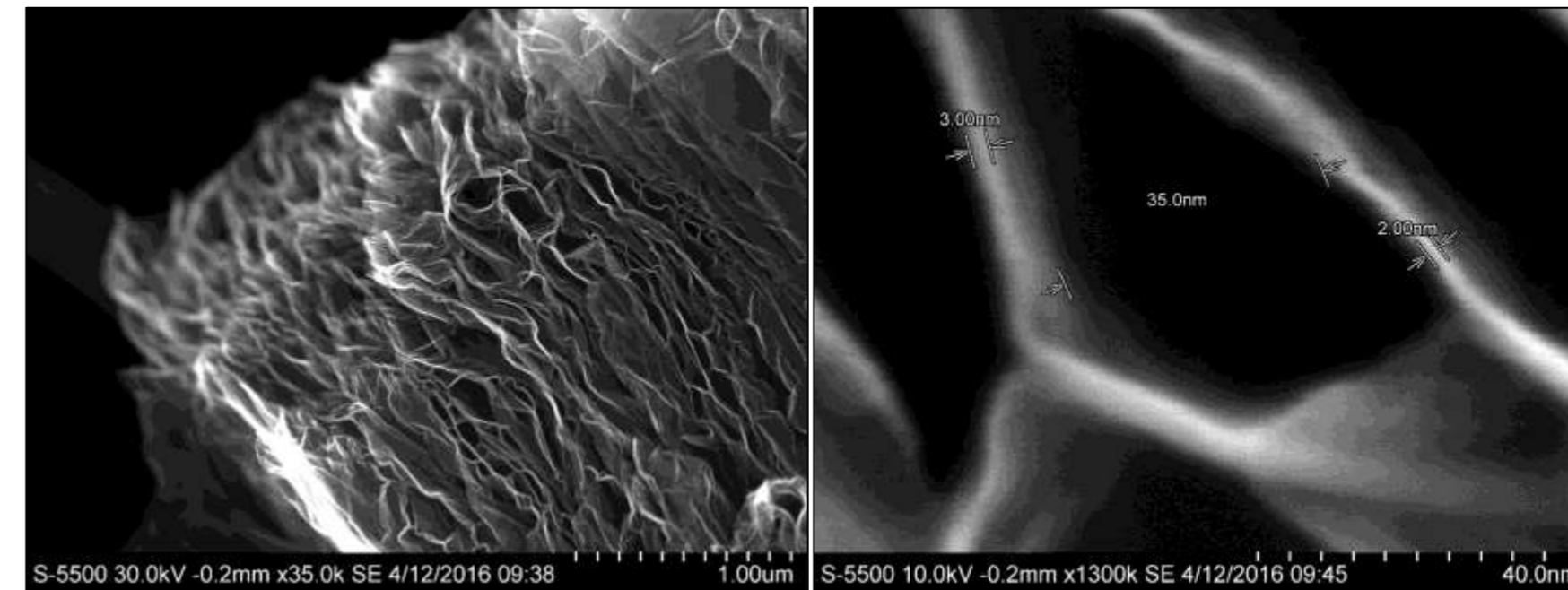
- ❖ What is graphene oxide (GO)?
- ❖ What is reduced graphene oxide (rGO)?



Property	GO	Graphene
Composition	~C ₂ O	C
Sheet Thickness	1 nm	0.3 nm
Sheet width	1 μm	∞
Conductivity	Insulator	Conductor
Wetting	Hydrophilic	Hydrophobic

Applications fields

1. Conductive inks
2. Energy, including batteries and super-capacitors
3. Composites
4. Biomaterials
5. Functional coatings



High resolution SEM of rGO powder:
 Left: The layered structure of rGO is clearly observable for rGO particle.
 Right: Individual sheets.



Present Production Capacity:
Normal GO: 3 Kg/day
Normal rGO: 1 Kg/day

Materials	Relative Elect. Conductivity
Normal rGO (routine)	1
Wearplex rGO series	10-500x <ul style="list-style-type: none">• High reduction temperature (800-1100 °C)• Additional annealing step• Low production capacity: 300 g/day• High cost• Voluminous, need to compact it for ink formulation





Future ink developments based on rGO

➤ GO scale-up as the main precursor for rGO

- Under development
- Production capacity 12x
- Cost reduction 4x

➤ Nitrogen doped rGO

- Under development
- One step reduction (800-1100 °C)
- Production cost 2-3x < rGO

➤ GO modification specifically to have less defective and higher conductive rGOs

- Under development
- Reducing annealing temperatures < 400 °C
- One step reduction → Conductivity > 100x
- Two steps reduction → Conductivity > 1000x
- Cost of highly conductive rGO reduced: 10x
- No need to compact it for ink formulation



Our plans for new production facility to start large scale production