2017

Uses for Graphene

Marcus R. Schmidt
Parkland College

Recommended Citation
https://spark.parkland.edu/nsps/125

Open access to this Poster is brought to you by Parkland College's institutional repository, SPARK: Scholarship at Parkland. For more information, please contact spark@parkland.edu.
USES FOR GRAPHENE

Marcus Schmid
Britt Carlson
CHE 101-006
10/23/16
INTRO

- **Graphene is a single layer of pure carbon atoms**
- Has much different chemical properties than graphite, what it is made from
- Extremely hard to produce 100% pure graphene
- Only recently has graphene become known to be useful
- (De La Fuente, “Graphene- What is it?”)
DESCRIPTION OF GRAPHENE

- Pure graphene is made of only graphite atoms
- Graphene is made either mechanically or through chemical methods
- Thinnest and lightest compound known by man
- Second most abundant element in our bodies
  - Safe to use for health, very ecologically friendly

(De La Fuente, "Graphene—What is it?")
GRAPHENE

- Shown is two layers of graphene
- When graphene is layered, it becomes graphite, and when graphite is separated into single layers, it becomes graphene
- Graphene is a term used to describe a single layer of graphite atoms

(De La Fuente, “Graphene-What is it?”)
USES FOR GRAPHENE

**Technology Industry**
- Faster charging, longer life batteries
- Graphene sensors for 3D cameras
- Night vision on self-driving cars
- Flexible Graphene Wi-Fi receptors
- Graphene sensors for smartphones

*Source: Carter et al., "20 ways graphene is about to change your life"*

**Health Industry**
- Robotic graphene hands
- Graphene contacts to cure blindness
- Graphene e-tattoos and fitness trackers
- Graphene motorcycle helmet

*Source: Carter et al., "20 ways graphene is about to change your life"*
RESEARCH ARTICLE SUMMARY

• **Graphene was used as a polymerization butyl acrylate**

• **Graphene has a high number of free radicals, Useful to break bonds within compounds like butyl acrylate**

• **The high free radical content is actually too high, and ends the polymerization to quickly**

• **Through reduction, or the removal of free radicals, the efficiency of graphene when used in the butyl acrylate polymerization process increases**

• **Graphene is given the name of graphite oxide (GO) and reduced graphene is called reduced graphite oxide (rGO)**

(Komeily Nia et al. 1)
WHAT IS BUTYL ACRYLATE?

- **Butyl Acrylate**
  - Used to make acrylic polymers and polyethylene
  - Component in cleaning products, aqueous resin, and dispersions for textiles and paper
  - Clear, colorless, flammable liquid with sharp odor

*(ICIS Chemical Business, "Chemical Profile: Butyl Acrylate")*
HOW IT'S DONE

- **Graphene sheets are made from chemical exfoliation of graphite to make graphene oxide**
- **After graphene sheets are made, they have a high free radical content**
- **To make the polymerization process the most efficient, the number of free radicals must be reduced**
- **This is done by light irradiation, thermal, and chemical treatments followed by further oxidation by acids to find efficiency of each method**

(Komeily Nia et al. 703)
HOW IT'S DONE, CONT.

• **Reduction** removes functional groups from nanosheet, removing dangling bonds and/or free radicals

• **After the reduction**, graphene is introduced to a sample of butyl acrylate

• **This begins the polymerization process**, which has a different efficiency rate for each way the graphene was reduced

(Komeily Nia et al. 708-711)
REDDUCING GRAPHENE RADICALS

- This picture shows the process of reducing a graphene sheet
  - (A) Shows graphite oxide (GO)
  - (B) Shows partially reduced graphite oxide
  - (C) Shows highly reduced graphite oxide (rGO)

- As shown, the number of free radicals decrease as a sheet of graphene is reduced until very few remain

(Komeily Nia et al. 709)
USING GRAPHENE TO POLYMERIZE

- These pictures show graphene radicals being used to initiate polymerization
  - (A) Shows GO to polymerize the surface of a bare silicon wafer
    - Considered the control
  - (B) Silicon wafer coated with rGO made from 4 hours of UV irradiation
  - (C) Silicon wafer coated with rGO made from 24 hours of UV irradiation
  - (D) Silicon wafer coated with GO
- This group of photos show the increase in efficiency of graphene as it is reduced more

(Komeily Nia et al. 709)
HOW OPTIMIZING FREE RADICALS IN GRAPHENE IS USEFUL

• **Useful in industry to make butyl acrylate polymerization more efficient, saves money and time**

• **Graphene oxide is hard to create and keep as single sheets of carbon**

• **From this, a promising look is to use this natural attraction to polymers that graft onto or absorb the graphene sheets that could result in extremely strong composite materials**

• **This experiment showed that the reduction of graphene is useful when controlled and optimized for use in polymerization of butyl acrylate**

(Komeily Nia et al. 710-711)
WORKS CITED


