

Northumbria Research Link

Citation: Wei, Jiacheng, Vo, Thuc and Inam, Fawad (2016) Processing of epoxy/ graphene nanocomposites. In: 6th Chemical Nanoscience Symposium (CNSN-6), 17 March 2016, Newcastle upon Tyne.

URL:

This version was downloaded from Northumbria Research Link:
<http://nrl.northumbria.ac.uk/29370/>

Northumbria University has developed Northumbria Research Link (NRL) to enable users to access the University's research output. Copyright © and moral rights for items on NRL are retained by the individual author(s) and/or other copyright owners. Single copies of full items can be reproduced, displayed or performed, and given to third parties in any format or medium for personal research or study, educational, or not-for-profit purposes without prior permission or charge, provided the authors, title and full bibliographic details are given, as well as a hyperlink and/or URL to the original metadata page. The content must not be changed in any way. Full items must not be sold commercially in any format or medium without formal permission of the copyright holder. The full policy is available online: <http://nrl.northumbria.ac.uk/policies.html>

This document may differ from the final, published version of the research and has been made available online in accordance with publisher policies. To read and/or cite from the published version of the research, please visit the publisher's website (a subscription may be required.)

www.northumbria.ac.uk/nrl



Introduction

Graphene can significantly improve physical properties of epoxy at extremely low loading when incorporated appropriately. However, in practical terms, graphene is not suitable to disperse in epoxy just by simple mixing, which is due to graphene's pronounced tendency to reaggregate in the matrix due to the strong van der Waals force between separately dispersed graphene sheets. In order to substitute traditional epoxy reinforcements with graphene, there are still some issues like dispersion, homogenization, and reaggregation. Therefore, the preparation of epoxy/graphene nanocomposites affects strongly to the final properties of nanocomposites.

In this work, graphene bundles have been dispersed in two-component epoxy system by bath sonication. Dispersion state and reaggregation behavior of graphene in this system have been studied. Light transmittance in ultraviolet-visible spectroscopy has been used to quantify the reaggregation by a series of controlled experiments.

Experimental

- Graphene dispersed in epoxy(EP) / hardener(HD) respectively by hand mixing for 5 s gently and then sonicated through bath sonicator.
- The effect of different sonication time, different storage time, different graphene concentration, and different sonication temperature have been studied.
- To prepare nanocomposites, graphene was first dispersed in hardener by bath sonication. Then mixed with liquid epoxy following thorough hand mixing for 10 mins.



Fig 1. SEM image of graphene

Fig 2. Graphene dispersion in different concentration

Results and Discussion

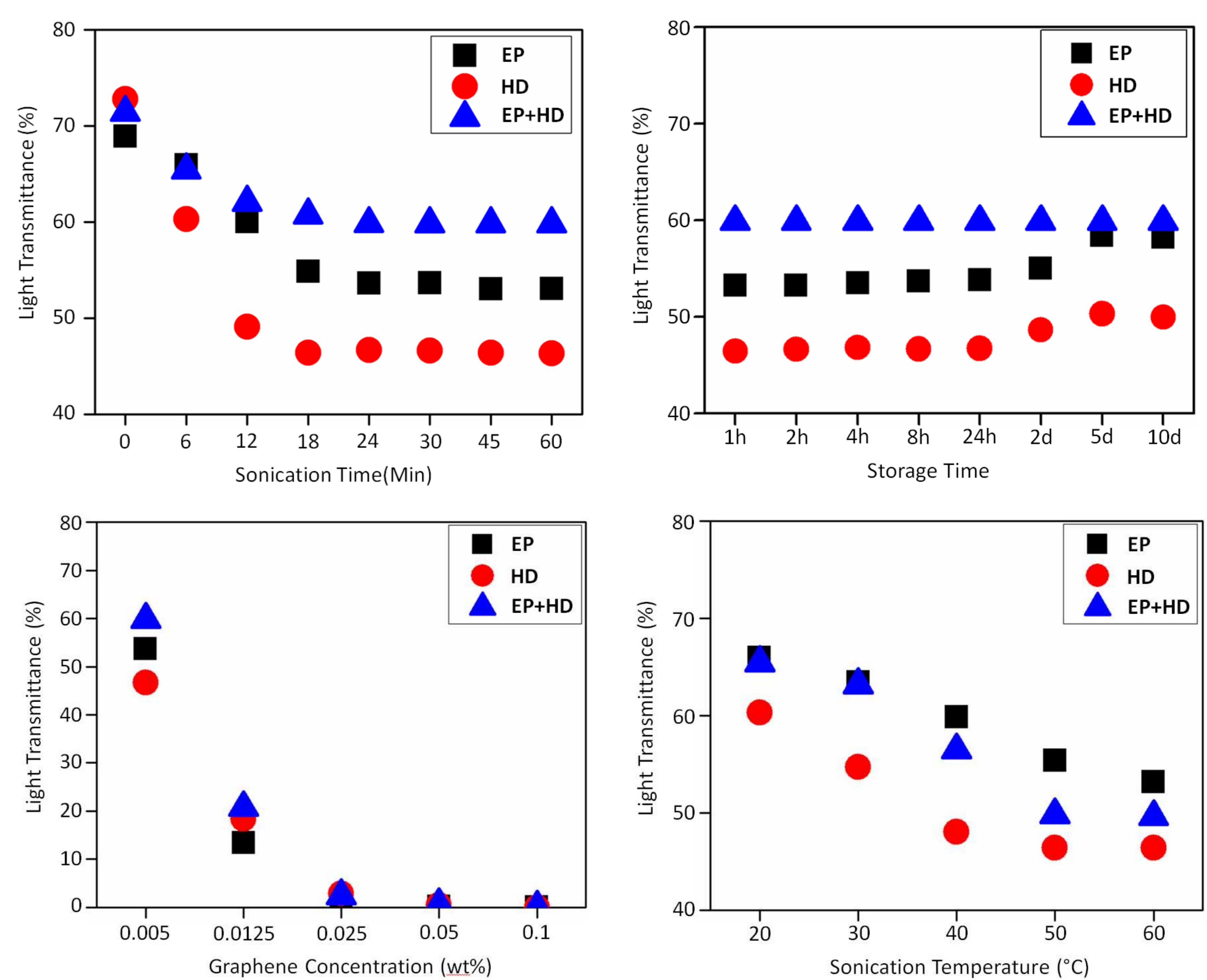


Fig 3. Using light transmittance to characterize the dispersion in liquids

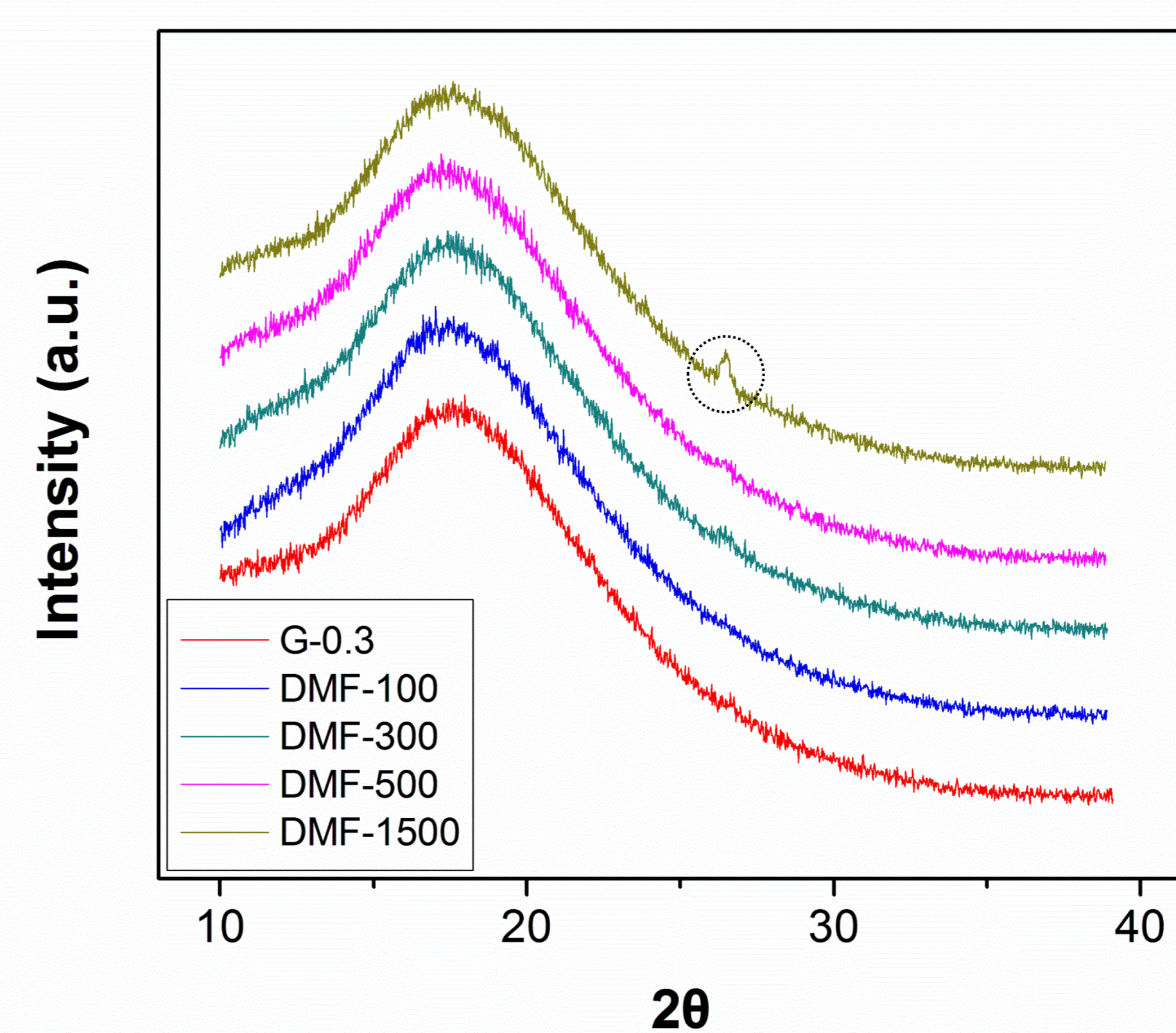


Fig 4. Using XRD to test the dispersion in composites

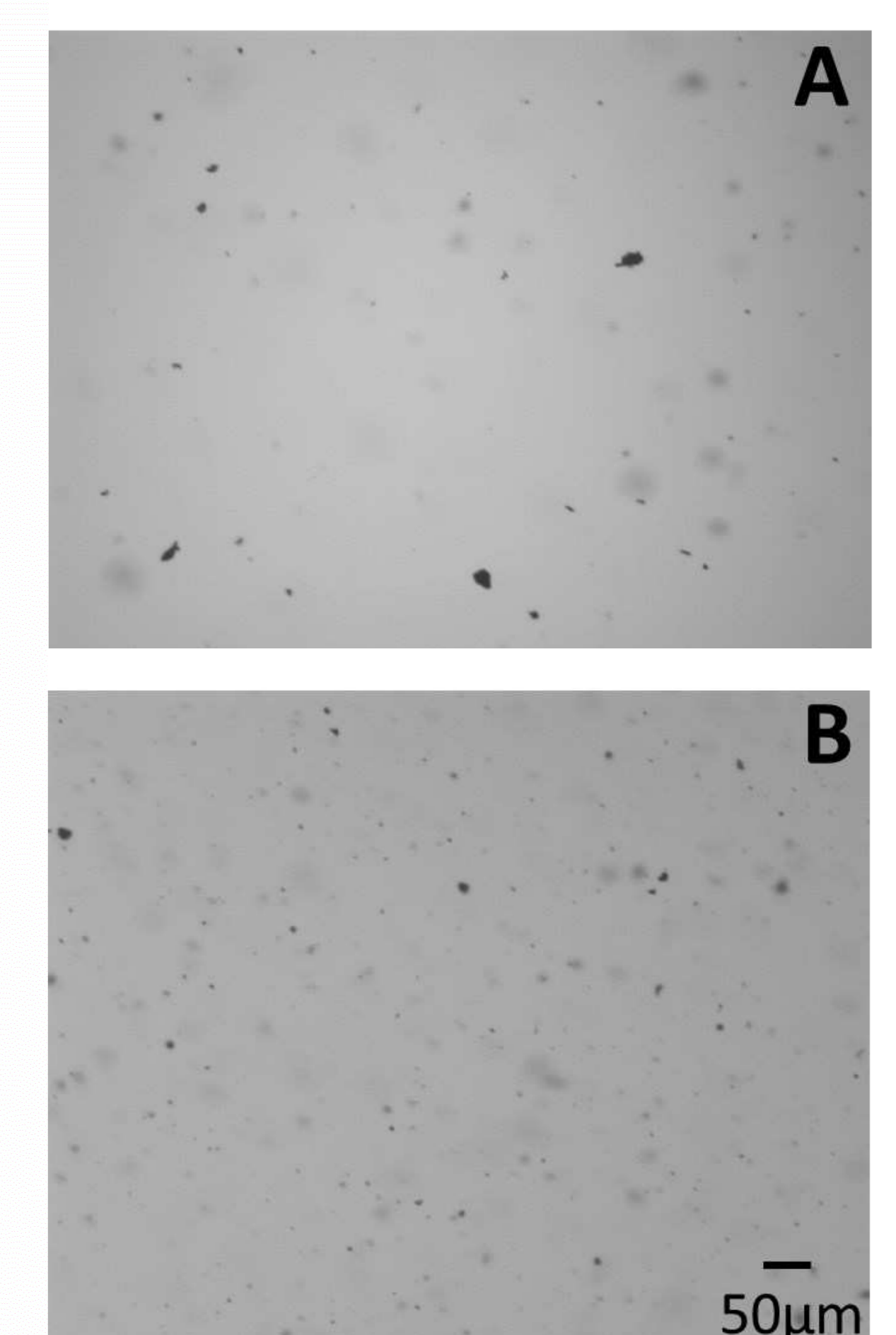


Fig 5. Graphene dispersion before/after sonication

Conclusions

- The more uniformly dispersed, the more light absorption.
- 18mins sonication is good to disperse graphene in epoxy system.
- No obvious aggregation happens during 10days storage.
- Reaggregation is more pronounced at higher concentration.
- The higher sonication temperature is, the easier to disperse.
- Viscosity significantly contribute to the dispersion

Acknowledgements

The authors would like to thank the Department of Mechanical and Construction Engineering, Northumbria University, for the provision of research facilities and research funding.

References

1. J Wei, R Atif, T Vo, and F Inam. Graphene Nanoplatelets in Epoxy System: Dispersion, Reaggregation, and Mechanical Properties of Nanocomposites. *Journal of Nanomaterials* 2015 (2015).
2. J Wei, T Vo, and F Inam. Epoxy/graphene nanocomposites—processing and properties: a review. *RSC Advances* 5.90 (2015): 73510-73524.