

論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	Fully exfoliated epoxy/organoclay nanocomposites: process development, properties and those mechanisms
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出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第9442号, 授与年月日:2014年3月26日, 学位の種別:課程博士, 審査員:久保内 昌敏,太田口 和久,Wiwut Tanthapanichakoon,吉川 史郎,森 伸介,青木 才子,塩谷 正俊
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第9442号, Conferred date:2014/3/26, Degree Type:Course doctor, Examiner:,,,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

(博士課程)
Doctoral Program

論文要旨

THESIS SUMMARY

専攻:	Chemical Engineering	専攻
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申請学位 (専攻分野):	博士 (Engineering)
Academic Degree Requested	Doctor of
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

The purpose of this study is how to obtain fully exfoliated organoclay in epoxy matrix using and to improve mechanical and anti-corrosion performances of epoxy/organoclay nanocomposites. Effect of physical clay dispersion, and combined mechanical and chemical clay dispersion in the epoxy matrix are evaluated. Mechanisms of clay exfoliation and nanocomposites properties development are discussed.

Physical clay dispersion is to obtain the suitable clay dispersion method into epoxy matrix via physical mixing methods (propeller mixer, three roll calendar and high speed mixing homogenizer). The nanocomposite preparation under high speed mixing method in the epoxy matrix performs better corrosion resistant compared to normal and shear mixing methods. After obtaining the suitable clay dispersion method, effect of mixing parameters and ultrasonic application were investigate. Mixing speed at 24,000 rpm with mixing duration about 60 minutes is recommended. Ultrasonic treatment is applied to induce well dispersion of clay, slightly large interlayer distance. Finally, effect of clay loading on mechanical property was evaluated. The appropriate clay loading of the nanocomposites for the mechanical properties was at 3 phr.

Chemical nanoclay dispersion using chemical exfoliators is focusing on combining physical clay dispersion with chemical clay dispersion method using chemical compounds. The chemical compounds are designed to various functional groups (epoxy and amine compounds) and size of molecular chain. Epoxy exfoliator has more effect on increasing degree of clay exfoliation compared to diamine exfoliator. Flexural modulus and diffusivity of the nanocomposites with diamine exfoliator obtains improving, however, with epoxy exfoliator is not much improving.

Effect of monoamine, diamine and triamine exfoliators on organoclay dispersion for fully epoxy/organoclay nanocomposites and their properties are examined. Flexural property of epoxy/organoclay nanocomposites with only monoamine clay exfoliator increase compared to neat resin and nanocomposites without clay exfoliators. Epoxy/organoclay nanocomposites with long molecular diamine exfoliator are recommended in the purpose of anti-corrosion. Epoxy/organoclay nanocomposites with triamine clay exfoliator were not able to homogeneously mix and shows phase separation which is cause to decrease flexural property and corrosion behaviour of the nanocompoistes.

Mechanisms of clay exfoliation and nanocomposites properties development are discusses on not only mechanisms of organoclay exfoliation, but also relationship between exfoliated clay structure and developed properties of nanocomposites. High speed mixing obtains higher degree of intercalation and exfoliation of clay compared to the other methods. Due to the higher degree of shear via high speed mixing involves the dispersion of large stacks into smaller ones took place and hence increases degree of intercalation/exfoliation. Ultrasonic application would assist to obtain less tighten clay galleries. Epoxy exfoliator would make fully exfoliated clay structure but the clays are not able to bond with the main epoxy network and it affects to reduce performance of the nanocomposites. In comparison between monoamine and diamine exfoliators, mechanical and barrier properties of nanocomposites with diamine obtains better performances because of more bonding to fix with the clay and the matrix. Increasing clay loading is increased stiffness due to increasing of bonded organoclays to fix the mobility of the polymer chain. The nanocomposite with long molecular diamine exfoliators has low weight uptake than other samples due to clay exfoliation and bonded organoclay with the main matrix would hindrance to the transport of fluid. It affects to decrease polymer mobility and lead to lower weight uptake of the solution.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).