

ACKNOWLEDGEMENTS

The work could not have been accomplished without the help and support from my advisor, Dr. Nandh Thavarungkul and my co-advisor Dr. Lada Punsukumtana. I thank them for valuable guidance and ideas since the beginning of the project. I wish to express my deepest gratitude to Suan Sunandha rajabhat university for allowing me pursue my doctorate study and for providing resources required to complete this work.

I also express their thanks to Dr. Nakorn Srisukhumbowornchai and Miss. Kaysinee Sriraksasin at King Mongkut's University of Technology Thonburi for consultation of x-ray diffraction, and to Thailand's Department of Science Service for COE and Eastern Polymer Industry Co., Ltd for particle sizes, and surface area studies.

I would also like to express my appreciation to my family and my coworker for their support and encouragement during the work.