

EFFECT OF DEPOSITION OF  
NANOPARTICLES DURING JOINING OF  
DISSIMILAR METALS BY FRICTION STIR  
WELDING

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## **SUPERVISOR'S DECLARATION**

We hereby declare that we have checked this thesis and in our opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy.

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I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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Thesis submitted in fulfillment of the requirements for the award of the degree of  
Doctor of Philosophy

Faculty of Engineering Technology  
UNIVERSITI MALAYSIA PAHANG

JUNE 2018

## ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my supervisor, Dr. Abdulla Bin Ibrahim, for his overwhelming guidance, patience, and the endless hours spent editing this draft. I feel very fortunate to have him as my supervisor, to have had the opportunity to work with him, and to have his helpful advice for the past three years. He has always been available and willing to have a discussion with me, even on his busiest days. Working with him has made this journey very pleasant, and for that, I am deeply grateful.

I would like to express my gratitude to my co-supervisors Dr. Che Ku Mohammad Faizal Bin Che Ku Yahya and Dr. Rama Raju Ram Gopal Varma for their dedicated support, professional guidance and for showing me what research is all about. This thesis would not have been possible without their valuable feedback.

My deepest gratitude is also forwarded to the Universiti management for providing excellent lab facilities for me to successfully carry out the project work in our department.

I would like to thank Universiti Malaysia Pahang for granting of Doctoral Scholarship Scheme (DSS) and providing me with financial assistance. My special acknowledgment goes to the Dean and Deputy Dean of Faculty of Engineering Technology for their continuous support and motivation towards my postgraduate degree. I would also like to thank all of the technical staff of Faculty of Engineering Technology.

I acknowledge that my achievement is a result of collaborating efforts from my lecturers, classmates and friends. I would also like to acknowledge my dearest family, whose ultimate concern and support enabled me to finish my study. Those whom I have not mentioned above, I wish to thank you all. Finally, my deepest gratitude goes to my beloved wife Mrs. B.Sree Laxmi for her patience and moral support throughout this work. This dissertation could not be done without her dedication and sacrifice.

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## LIST OF ABBREVIATIONS

AA	Aluminium Alloy
Al <sub>2</sub> O <sub>3</sub>	Aluminium oxide
ASTM	American society of testing materials
Cu	Copper
EDM	Electrical Discharge Machining
EBW	Electron Beam Welding
EDX	Electron dispersive X-ray analysis
FESEM	Field emission scanning electron microscope
FSW	Friction Stir Welding
FSP	Friction Stir Processing
GTAW	Gas tungsten arc welding
HAZ	Heat affected zone
HSS	High Speed Steel
Hv	Hardness Vickers
MPa	Megapascal
MWCNT	Multi-walled carbon nanotubes
NC5T	Numerical Control 5Tons
NZ	Nugget zone
Rpm	Revolutions per minute
SEM	Scanning electron microscope
SZ	Stir Zone
TiO <sub>2</sub>	Titanium dioxide
TMAZ	Thermo-mechanically affected zone