Project Title:	Converting carbon dioxide to fuels using plasma
Name of Supervisor:	Dr Emma Lovell
Email of Supervisor:	e.lovell@unsw.edu.au
Name of Joint/Co-Supervisor:	Prof Rose Amal and A/Prof Jason Scott
Email of Joint/Co-Supervisor:	r.amal@unsw.edu.au
School:	School of Chemical Engineering
Faculty Research Area (Theme):	Advanced Materials
School Research Area:	Energy
Applicable to other Engineering schools/disciplines:	
Terms:	Term 2 Term 3
Abstract:	The mitigation of carbon dioxide emissions to the atmosphere via catalytic conversions to fuels poses a promising route to avoid the impacts of global warming. The methanation of carbon dioxide using catalytic systems is a viable route to CO2 valorisation, however, significant energy inputs are required (conventionally using heat at ?400 °C). The use of plasma (the fourth state of matter that occurs naturally in the form of lightening or hot plasma in the sun) can aid in reducing this overall energy input. This project endeavours to design catalysts for the room temperature plasma conversion of carbon dioxide into methane and water. Overall, a suitable catalyst for this conversion remains elusive. Nickel is considered as one of the most efficient metals for methanation. Under plasma, Ni provides high activity for the methanation reaction however the support also contributes to the overall catalyst performance. Commercially, alumina is considered as the most effective support but in plasma catalysis it has been found that mixed supports such as titania/alumina outperform alumina alone.
Research Environment:	The student undertaking this project will be working at the Particles and Catalysis Research Group, School of Chemical Engineering, under the guidance of Dr Emma Lovell, A/Prof Jason Scott and Prof Rose Amal. For more information on this project please contact Dr Emma Lovell
Novelty and Contribution:	A novel approach to address some of the technical issues such as selection of suitable active metal and/or promotor as well as the support that controls the catalytic performance
Expected Outcomes:	The aim of the study is to screen the suitable metal and support with the emphasis to develop understanding of plasma-based reaction in comparison to thermal catalysis.
Reference Material Links:	[1] E. J. Jwa, Y. S. Moka, and S. B. Lee, “Conversion of carbon oxides into methane in a nonthermal plasma-catalytic reactor.,” Eur. Phys. J. Appl. Phys., vol. 56, no. 2, p. 24025/1- 24025/4, 2011. [2] J Horlyck, C Lawrey, EC Lovell, R Amal, J Scott, 2018, Elucidating the impact of Ni and Co loading on the selectivity of bimetallic NiCo catalysts for dry reforming of methane,Chemical Engineering Journal, v352, p 572-680

[3] M. Nizio et al., “Low temperature hybrid plasma-catalytic methanation over Ni-Ce-Zr
hydrotalcite-derived catalysts,” Catal. Commun., vol. 83, pp. 14–17, 2016.

Will the student visit the premises of an industry partner, or undertake any activity on premises external to UNSW?	No