



PhD proposal, starting October 2010
“Modelling of a rotary kiln for Al recycling”



Place of work

Institut Jean Lamour, Ecole des Mines de Nancy, France, in the research group “Metals processing”. Thesis advisors: Prof. F. Patisson (supervisor) and Prof. J.P. Bellot. Work in collaboration with Dr. Anne Pichat, ALCAN, Centre de recherche de Voreppe, France.

Description of the project

Sustainability of the aluminium industry is mostly achieved through a high ratio of metal recycling. At ALCAN Neuf-Brisach plant, used beverage cans are recycled to cast new metal and a specific rotary kiln is the first reactor of the process. Its operation is complex and its energy consumption high. ALCAN aims to reduce the energy consumption of its rotary kilns, to increase their productivity, whilst maintaining or improving Al and Mg yields. Mathematical modelling of the process, in collaboration with Institut Jean Lamour, is the approach selected for this project.

The applicant will be in charge of developing such a mathematical model and conducting a limited series of supporting experiments. Physics of the process include heat transfers by radiation, conduction and convection, phase changes (melting and vaporization), combustion, mass transport and mass transfer in solid, liquid and gas phase. A stepwise approach will be followed. Firstly, the burner will be modelled, then the burner-charge-wall heat transfer will be addressed and, lastly, the dynamic behaviour of the solid lumps, the liquid metal and the slag will be taken into account. Numerical solution will be obtained using a CFD software.

Profile

Applicant with an Engineer degree or a Master degree in metallurgical or chemical engineering, with a good background in transport phenomena (heat and mass). Knowledge in numerical simulation would be appreciated. Fluency in English is required and German knowledge welcome. The applicant should be able to work in both academic and industrial environment.

Funding

Bourse CIFRE, a 3-year contract with ALCAN, around 2870 € gross per month.

Contacts

Fabrice Patisson or Jean-Pierre Bellot, IJL, Ecole des Mines, Nancy, France. Tel: +33 383 584267. E-mail: fabrice.patisson@mines.inpl-nancy.fr, jean-pierre.bellot@mines.inpl-nancy.fr

Anne Pichat, CRV, ALCAN, Voreppe, France. Tel: +33 476 578190. E-mail: anne.pichat@alcan.com