Exjobb

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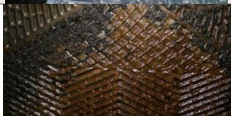Arash +46 72 564 00 18
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Measurement of fouling in plate heat exchangers – M.Sc. Thesis Work Proposal

Background

Heat exchangers get fouled when in operation. Fouling occurs when foreign materials that may be present in the application (e.g. hydrates of metal oxides, calcium precipitates, organics, biological matter) build-up layers of deposits on the surface of the heat exchanger plates, see figure below.

Fouling type	Description	Examples	Picture
Bio fouling	Microorganisms that grow on the heat transfer surface	Algae, microbiological growth, slime, mussels	
Solidification	Organic components in the medium that solidifies at the heat exchanger surface when their cloud point is reached	Fat, oil, heavy fuel oil, lube oil	
Crystallization	Deposition of dissolved salts on the heat transfer surface	Calcium carbonate, calcium phosphate, calcium sulphate - gypsum, iron carbonate, limestone, magnesium carbonate, magnesium sulphate/sulphite, zinc carbonate	
Sedimentation/ Particulate	Fine particles that settles on the heat transfer surface	Iron oxides (hematite, magnetite), Jarosite (sulphate mineral, $KFe_3(OH)_6(SO_4)_2$), rust and silica	
Chemical	Breakdown or polymerisation of molecules that stick to the plate in food or petrochemical applications	Dairy	

Fel! Det går inrte att hitta någon referenskälla. of fouling in plate heat exchangers

As the fouling increases, the performance of the heat exchanger deteriorates. This results in higher operational costs for the customer, risks for stops and lower expected output. Heat exchanger plates can then be sent for a service in which plates are cleaned and the heat exchanger is "reconditioned".

It is not always desired or possible to clean the plates to a "as new" condition. Avoiding unnecessarily long cleaning cycles (and, in general, optimising the process) would require a robust means to assess the degree of fouling (or cleanliness) after cleaning. Today, we lack such a means.

Objectives

The present thesis project aims at developing a working prototype for the semi-qualitative measurement of the degree of fouling on PHE plates.

The project includes

- a literature study of possible measurement principles and existing methods for this or similar measurements cases including estimations of expected measurement uncertainties,

- designing and producing a prototype based on the most promising principle and suitable for the measurement situations encountered within Alfa Laval, and

- testing and validation of the prototype.

The project may include

- identifying possible producers of the measurement system.

Limitations

The project will not include

- full scale production of the measurement system.

Proposal

As the scope of the project is wide, we suggest to involve two master thesis candidates to conduct this study. The candidates should together have the competences: Analytical with the ability to do screening and selection work and interest in a multidisciplinary area of applied physics/electrical measurement systems.

It is preferred that the study is carried out during the 2018 spring semester.

Supervisor

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