

OPSCC

Optimizing surface finish to Prevent SCC initiation in energy industries

MAIN PARTICIPANTS

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OVERVIEW (keep within this page)

Starting year: 2017

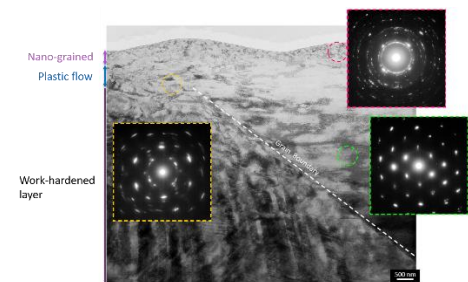
Current researchers (permanent/non-permanent): 2/1 person-month

Positioning <i>(Multiple selection allowed – total 100%)</i>	Transpor tation	Energy	Eng. for Health	Include partner from <input type="checkbox"/> Outside ELYT <input type="checkbox"/> Industry
				Main funding source(s) <input checked="" type="checkbox"/> Public project(s) <input type="checkbox"/> Industrial <input checked="" type="checkbox"/> Own resources
				IFS CRP/LyC project? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
				For main projects: Agency / year / name of project (up to 3, past projects in gray)
Materials and structure design				Estimated annual budget:
Surfaces and interfaces		100%		
Simulation and modeling				
Other:				

Highlights & Outstanding achievements (3-5 bullet points)

- Development of a new methodology to characterize semiconductive properties of passive layer
- Evidence of the modification of the electronic properties of passive film due to affected surface state by dry grinding
- Transposition of the methodology to oxide layer formed in representative environment
- Evidence of the correlation between the subsurface modification due to dry grinding and the oxide film chemistry, structure and properties

Illustration (5x5 cm² max)



TEM image with electron diffraction patterns of the top surface of the grinder-finished specimen.

PROJECT DESCRIPTION

Background (10 lines max; Calibri 11)

It has been recently recognized that surface finish has strong impact on SCC susceptibility of alloys in various kinds of environments, including boiling water reactor coolant, primary water of pressurized water reactors, and chloride containing water. Industry needs appropriate surface finish procedures to reasonably minimize SCC susceptibility of alloys. To achieve an effective answer to this demand, we need to know the following items as a function of surface treatment:

- Physical metallurgy of alloy surface (micro- and nano-structure of surface).
- Electrochemical properties, in particular, stability of passivity.
- SCC initiation dynamics (embryo formation and repassivation, coalescence of micro-cracks).

All those properties need to be linked to each other to understand the effect of surface finish on SCC susceptibility of alloys.

Key scientific question (2 lines max; Calibri 11)

Discriminate the effect of subsurface modification on the reactivity of SS
Correlate the change in surface reactivity to SCC susceptibility

Research method (8 lines max; Calibri 11)

In 2017-2018, passive film characterizations have been performed at MATEIS on material provided by GSE-TU. The film properties (capacitance, resistance, number of defect) were evaluated for several surface preparation that will be used for SCC experiments in GSE-TU.

In 2018-2019, detailed characterizations of the work hardened surface layers formed on austenitic stainless steels with different surface finish methods (grinder, emery paper, and colloidal silica) were carried out using a TEM and an EBSD technique.

In 2019-2020, Electrochemical analysis for passive films formed in several environments including high temperature water were also carried out.

Research students involved (*gray color for previous years*)

Ph.D. candidates (years, institution):

- Kathleen JAFFRE (2017-present, DD INSA-LYON/ TOHOKU)
(INSA: October 2017 - December 2018 and December 2019 –present)
(TOHOKU: January 2019- December 2019)

Master/Bachelor students (years):

Visits and stays (*gray color for previous years*)

FR to JP (date, duration):

- K. Jaffre (Ph.D. candidate), stay at QSE (Tohoku), January 2019 (1 year)

JP to FR (date, duration):

- H. Abe (Senior Assist. Prof.), stay at MATEIS (INSA-Lyon), March 2018 (1 week)
- N. Mary (Assoc. Prof.), stay at MATEIS (INSA-Lyon), November 2017 (1 week)

COMMUNICATIONS AND VALORIZATION

Journal publications *(gray color for previous years)*

	Authors	Title	Journal	Vol.	pp. / ID	Year	DOI
1	K. Jaffré, B. Ter-Ovanessian, H. Abe, N. Mary, Y. Watanabe, B. Normand	Effect of dry grinding on the surface microstructure and passive behavior of stainless steel 304L	Applied Surface Science	-	-	submitted	-
2							

Conferences *(gray color for previous years)*

	Authors	Title	Conference	Date	City	Country	DOI (if applicable)
1	K. Jaffré, B. Normand B. Ter-Ovanessian, , N. Mary, Y. Watanabe, H. Abe	<i>Effect of surface finishing on the corrosion of austenitic stainless steel 304L in simulated BWR and PWR environments</i>	Eurocorr 2020	6-10 Sept. 2020	Virtual	Virtual	
3	K. Jaffré, B. Normand B. Ter-Ovanessian, , N. Mary, Y. Watanabe, H. Abe	<i>Influence of mechanical surface finishing on the properties of passive film formed on stainless steel using electrochemical impedance spectroscopy measurements</i>	Eurocorr 2019	9-13 Sept. 2019	Sevilla	Spain	
3	K. Jaffré, B. Ter-Ovanessian, B. Normand, N. Mary, Y. Watanabe, H. Abe	<i>Influence des traitements mécaniques de surface sur les propriétés du film passif formé sur les aciers inoxydables des internes de cuve</i>	Matériaux 2018	19-23 Nov. 2018	Strasbourg	France	