

IofDIAMS

Low and ultralow friction of microcrystalline diamonds films towards smart and tribo-resistant coatings

MAIN PARTICIPANTS

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OVERVIEW (keep within this page)

Starting year: 2016

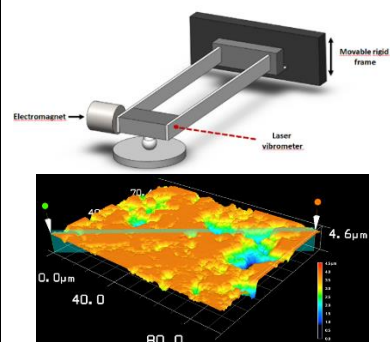
Current researchers (permanent/non-permanent): 2 person-month/year

Positioning <i>(Multiple selection allowed – total 100%)</i>	Transportation	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 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 <ul style="list-style-type: none"> Institut Carnot I@L, France Frontier Research Institute for Interdisciplinary Sciences, Tohoku University/2016-2018/ International Collaborative Research Project
Materials and structure design	20 %	30 %		Estimated annual budget: N/A (2020)
Surfaces and interfaces	15 %	30 %		
Simulation and modeling	5 %			
Other:				

Highlights & Outstanding achievements (3-5 bullet points)

- Succeeded in developing a measurement system.
- One publication has been accepted in Tribology Online.

Illustration (5x5 cm² max)



PROJECT DESCRIPTION

Background (10 lines max; Calibri 11)

A project has started, concerning low and ultralow friction of carbon-based coatings. It is related to "Superlubricity". The objective is to describe the low friction behavior of partially-polished microcrystalline diamond films. The goal is to depict and precisely quantify the different contributions to friction (velocity-dependent and Coulomb-type contributions), in different contact conditions. Experimental work is involving mainly 1) coating elaboration in TU, 2) and the "oscillating relaxation tribometer" technique in LTDS. Those films will be applied as the smart and tribo-resistant coatings, especially to the bearings under extreme environments.

Key scientific question (2 lines max; Calibri 11)

Characterization of the low-friction behavior for the tribosystem.

Try to quantify the "solid-type friction" and "velocity-dependent" contribution in friction.

Research method (8 lines max; Calibri 11)

Friction characterization has been achieved thanks to the oscillating relaxation tribometer, developed at LTDS, in order to measure the kinematic friction between two sliding surfaces. This technique is based on the study of the dynamic free-response of a single degree-of-freedom mechanical oscillator, in which the sliding contact acts as a damper. It has been beneficially used to determine the velocity-independent and velocity-dependent friction contributions, with no need for any direct friction force measurement. The samples of the diamond coatings were deposited by the Hot Filament CVD method on SiC ceramics substrate. Deposited microcrystalline diamond films were then carefully polished, inducing surface topography changes.

Research students involved (gray color for previous years)

Ph.D. candidates (years, institution):

Master/Bachelor students (years):

Visits and stays (gray color for previous years)

FR to JP (date, duration):

- M. Belin (IR CNRS), stay at IFS (TU), September 2019 (1 day)
- M. Belin (IR CNRS), stay at IFS and FRIS (TU), February 2018 (1 week)

JP to FR (date, duration):

- H. Miki (Assoc. Prof.), stay at LTDS (ECL), December 2018 (4 days)
- H. Miki (Assoc. Prof.), stay at LTDS (ECL), February 2017 (4 days)

COMMUNICATIONS AND VALORIZATION

Journal publications *(gray color for previous years)*

	Authors	Title	Journal	Vol.	pp. / ID	Year	DOI
1	M. Belin, H. Miki and T. Takagi	<i>Friction laws determination of random-textured surface of microcrystalline diamond coatings, using the oscillating tribometer technique</i>	Tribology Online	14(3)	109-114	2019	doi:10.2474/trol.14.109

Conferences *(gray color for previous years)*

	Authors	Title	Conference	Date	City	Country	DOI <i>(if applicable)</i>
1	Hiroyuki MIKI, Michel BELIN	<i>Low and ultralow friction of microcrystalline diamonds films ~ towards smart and tribo-resistant coatings</i>	ELyT Workshop 2019	12 March, 2019	Osaki	Japan	
2	M. Belin, H. Miki, T. Takagi	<i>Low-friction characterization of random-textured surface of microcrystalline diamond coatings, thanks to the relaxation tribometer technique</i>	6th World Tribology Congress	17-22 Sep. 2017	Beijing	China	