

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM**Field: Materials****Subfield:** (Applied Physics, Chemistry, Mathematics, Mech. Eng....)

Applied Physics-Chemistry.

Title: Electrostrictive and Triboelectric fibers for Vibrational Energy Harvesting.**ParisTech School:** ESPCI Paris PSL**Advisor(s) Name:** COLIN Annie**Advisor(s) Email:** annie.colin@espci.fr**Research group/Lab:** MIE CBI**Lab location:** ESPCI Paris PSL 10 rue Vauquelin 75005 Paris**(Lab/Advisor website):** <https://www.cbi.espci.fr/accueil-22/>

Short description of possible research topics for a PhD: The decreasing energy consumption of today's portable electronics has invoked the possibility of energy harvesting from the ambient environment for self-power supply. One common and simple method for vibration energy harvesting is to utilize triboelectricity or electrostriction. In this thesis, we propose to synthesize fibers to make smart fabrics. This fabric will be efficient and washable. Two types of fibers will be manufactured by dip-coating : electrostrictive fibers and triboelectric fibers. For this we will take advantage of the previous studies in the laboratory [1,2,3].

We will compare the performance of the two systems of fibers as a function of humidity. The second step will be to evaluate the performances of the fibers by preparing a self heating fabric. The garment will be heated by joule effect. Some conductive fibers will be used in the fabric and connected to the

In a third step we will store the produced energy and used it to cool the fabric.

Required background of the student: (What should be the main field of study of the applicant before applying?)

The student should have a solid training in chemistry , chemical formulation and be an experimentalist. Knowledge of electronics is recommended.

A list of 5 (max.) representative publications of the group:

1. M Pruvost, WJ Smit, C Monteux, P Poulin, A Colin - npj Flexible Electronics, 2019. Polymeric foams for flexible and highly sensitive low pressure capacitive sensors.
2. W.Smit, C Kusina , JF Joanny, A Colin PRL 123(14) 148002. Stress field inside the bath determines dip coating with yield stress fluids in cylindrical geometry.
3. M.Pruvost, WJ Smit, C Monteux, P Poulin, A Colin Multifunctional Materials 1 (1) 015004 2018 Microporous electrostrictive materials for vibrational energy harvesting
4. Yuan, Jinkai, Alan Luna, Wilfrid Neri, Cécile Zakri, Annie Colin, and Philippe Poulin. "Giant electrostriction of soft nanocomposites based on liquid crystalline graphene." *ACS nano* 12, no. 2 (2018): 1688-1695.
5. Nesser, Hussein, Hélène Debéda, Jinkai Yuan, Annie Colin, Philippe Poulin, Isabelle Dufour, and Cedric Ayela. "All-organic microelectromechanical systems integrating electrostrictive nanocomposite for mechanical energy harvesting." *Nano Energy* 44 (2018): 1-6.