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Département de Chimie et Physique des Surfaces et des Solides
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Title: Influence of resonant levels on the thermoelectric properties of quasi-2D topological insulators

Team: Thermoelectric Materials (204), Institute Jean Lamour (IJL, Nancy, France)

PhD supervisors: Christophe Candolfi (supervisor), Bertrand Lenoir (co-supervisor)

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Abstract

Over the last decade, several thermoelectric compounds have been revisited for their topological surface states giving rise to peculiar physical properties. The electronic band structure of these compounds, which exhibit a quasi-2D crystal structure formed by stacked layers, can be manipulated by the introduction of specific impurities which create a resonant level. This level induces a local distortion of the electronic density of states that yields enhanced thermoelectric properties. This level can also induce a superconducting state at very low temperatures.

In this PhD, the candidate will realize a detailed experimental study of the influence of these levels on the thermoelectric properties of these compounds. The research activities of the candidate will include the synthesis of both single-crystal and polycrystalline samples, their thorough structural and chemical characterizations and measurements of their transport properties (electrical resistivity, thermopower, thermal conductivity, Hall effect, specific heat) at low (1.8 – 300 K) and high temperatures (300 – 1000 K). A particular attention will be paid to the possible emergence of a superconducting state. These results will be complemented by additional experiments including angle-resolved photoemission studies performed in large facilities and in collaboration with another team of our institute. These studies will aim at better understanding the modifications induced by the resonant level on the electronic band structure. All the necessary instruments to perform these studies are available in IJL.

Candidate profile: The candidate should have a strong background in either materials science, solid-state physics or solid-state chemistry, and a strong motivation for experiments. French language is not required. However, fluent English (spoken, read, written) is mandatory.

To apply: send your CV, marks obtained during the last three years and recommendation letters to christophe.candolfi@univ-lorraine.fr or bertrand.lenoir@univ-lorraine.fr before 2020, March 15th.