



# MATERIALS SCIENCE

UNIVERSITY OF ROME  
TOR VERGATA



## MATERIALS SCIENCE SEMINAR

10/1/2019 2.30 pm

Grassano room

Sogene Building



### **“Solar Thermionic-Thermoelectric Generator (ST<sup>2</sup>G): Concept, Materials Engineering, and Prototype Demonstration ”**

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An innovative solid-state power generation technology for solar concentrators based on a combined thermionic-thermoelectric converter, able to cogenerate electric and thermal energy, is proposed and discussed. A conversion module, working under vacuum, was fabricated consisting of a radiation absorber made of a hafnium carbide-based material with properties of thermal and mechanical stability at the operating temperatures. The absorber surface was properly tailored by a femtosecond laser treatment to induce the formation of periodic ripples which enhance the solar absorbance up to values >90%. CVD diamond films were deposited on the absorber surface not exposed to the radiation. The films, characterized by a hydrogen surface termination, act as thermionic emitter operating at lower temperatures than standard emitters. Electrons emitted by CVD diamond are collected by a metal anode, which is thermally connected to a commercial thermoelectric generator, that provides an additional combined thermal-to-electric conversion. For the first time the conversion module was designed, fabricated and tested under concentrated solar radiation with 6% of thermal-to-electric conversion efficiency and huge potential of improvement.