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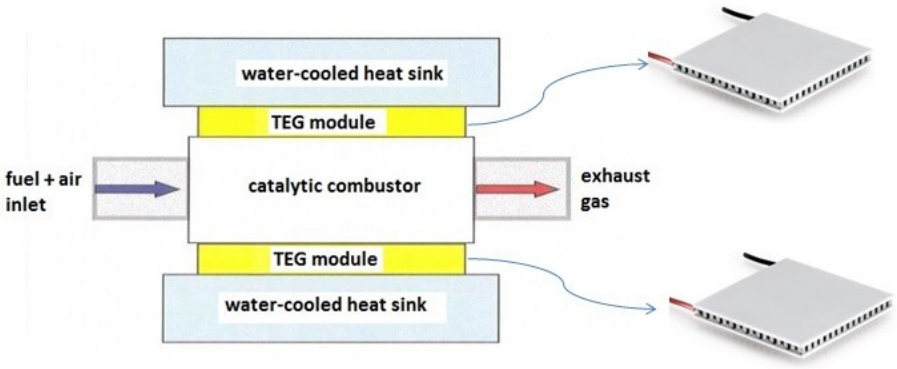
SEMINARIO

sala Q4 P1 16
via R. Cozzi, 53
20125 Milano

Consiglio Nazionale delle Ricerche
Istituto per l'Energetica e le Interfasi
U.O.S. di Milano

STUDY OF A CATALYTIC MESO-SCALE COMBUSTOR COUPLED WITH THERMOELECTRICAL DEVICES FOR PORTABLE ENERGY PRODUCTION



ing. Laura Merotto
CNR IENI, UOS di Milano

During the last few years, the miniaturization of mechanical and electromechanical engineering devices have received growing attention, thanks to the increasing interest in the areas of microelectronics, biomechanics, and also to the progress made in microfabrication techniques. The advances in miniaturized mechanical devices open exciting new opportunities for combustion, especially in the field of micro power generation, allowing the development of power-supply devices with high specific energy (small size, low weight, long duration). Even at 10% energy conversion efficiency hydrocarbon fuels can provide 10 times the energy density of the most advanced batteries. Therefore, the growing interest in miniaturized devices is further boosted by the desire to replace batteries with hydrocarbon-based fuels for portable power sources. In this context, both homogeneous combustion and catalytic reactors are of major interest.

The development of a device based on catalytic combustor coupled with thermoelectric modules is particularly attracting for combustion stability and safety. Furthermore, when implemented in micro-meso scale devices, catalytic combustion allows fully utilization of the high energy densities of hydrocarbon fuels, but at notably lower operating temperatures than those typical of traditional combustion. These conditions are more suitable for coupling with conventional thermoelectric modules, preventing their degradation.

In this work a novel catalytic meso-scale combustor fuelled with propane/air mixture has been coupled with two conventional thermoelectric modules. The wafer-like combustor is filled up with commercially-available catalytic pellets of alumina with Platinum (1% weight). In order to calibrate the operating conditions, the analysis of the temperature values and distribution across the combustor surfaces have been carried out.

Characterization of exhaust gases concentration and of pellet aging were performed in order to investigate combustor properties. The results of the combustor behavior characterization guided the coupling of the combustor with commercially available thermoelectric modules using at the cold side a water cooled heat exchanger. The system obtained has been characterized in different operating conditions measuring the delivered electric power in different operating conditions. Efficiency estimation proves that the system is suitable for small portable power generation.

Informazioni

ing. Laura Merotto
tel.: +39 02 66173 343
e-mail: merotto@ieni.cnr.it