

Letter

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A thermally self-sustained micro solid-oxide fuel-cell stack with high power density

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High energy efficiency and energy density, together with rapid refuelling capability, render fuel cells highly attractive for portable power generation^{1, 2}. Accordingly, polymer-electrolyte direct-methanol fuel cells are of increasing interest as possible alternatives to Li ion batteries³. However, such fuel cells face several design challenges and cannot operate with hydrocarbon fuels of higher energy density. Solid-oxide fuel cells (SOFCs) enable direct use of higher hydrocarbons^{4, 5, 6}, but have not been seriously considered for portable applications because of thermal management difficulties at small scales, slow start-up and poor thermal cyclability. Here we demonstrate a thermally self-sustaining micro-SOFC stack with high power output and rapid start-up by using single chamber operation on propane fuel. The catalytic oxidation reactions supply sufficient thermal energy to maintain the fuel cells at 500–600 °C. A power output of ~350 mW (at 1.0 V) was obtained from a device with a total cathode area of only 1.42 cm².

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