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TITLE (AND CASE NUMBER) OF INVENTION

IMPROVED SOLID OXIDE PROTON CONDUCTORS (0903)

INVENTORS

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APPLICATIONS

Alternative energy; Fuel cells. This invention addresses the greatest operational weakness of solid oxide fuel cells.

SUMMARY

We have developed a facile method for increasing proton conductivity in metal oxide proton transport membranes (used, for example, as solid electrolytes in fuel cells). By irradiating suitable metal oxides (e.g., Titanium dioxide, perovskite oxides) with specific wavelengths of IR light, thereby exciting targeted vibrational bonding modes, we have increased the proton tunneling rate (a key component of proton conductivity) by *seven orders of magnitude*. This invention is particularly relevant for solid oxide fuel cells ("SOFCs"), as it could overcome their greatest disadvantage.

Fuel cells are energy-converting devices that use an oxidizer (e.g., oxygen in air) to convert the chemical energy in fuel (e.g., hydrogen) into electricity. A solid oxide fuel cell typically contains a solid electrolyte layer with an oxidizer electrode (cathode) on one side of the electrolyte and a fuel electrode (anode) on the other side. SOFCs are one of the most promising fuel cell designs for stand-alone and commercial high power applications. Advantages of SOFCs include high efficiencies, long term stability, fuel flexibility, low emissions, and cost. They typically operate at intermediate to high temperatures (400-1000°C) and reach efficiencies on the order of 60%. The high operational temperatures can be put to good use; for example, when excess heat can be used to drive a conventional turbine for hybrid power generation. However, the high operational temperature is also the biggest disadvantage of SOFCs, resulting in longer start up times, chemical compatibility concerns, and mechanical breakdown.

Our invention addresses this disadvantage, as the increased proton conductivity resulting from IR illumination can substantially reduce the effective operating temperatures. In practice, IR illumination can be provided by simple diodes, and there are numerous designs that could incorporate our invention into robust fuel cells. In summary, simple infrared illumination of solid electrolytes in fuel cells could greatly increase performance and reliability.

PATENT STATUS

Pending U.S. Patent Application 12/617,387

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