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Compact LWIR Borescope Sensor for Surface Temperature of Engine Components

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Abstract : The durability of a combustor in gas-turbine enginesrequiresa good control of its component temperatures. Since the temperature of combustion gases frequently exceeds the melting point of the combustion liner walls, an efficient air-cooling system is significantly important to elongatethe lifetime of liner walls. To determine the effectiveness of the air-cooling system, accurate 2D surface temperature measurement of combustor liner walls is crucial for advanced engine development. Traditional diagnostic techniques for temperature measurement, such as thermocouples, thermal wall paints, pyrometry, and phosphors, have shown disadvantages, including being intrusive and affecting local flame/flow dynamics, potential flame quenching, and physical damages to instrumentation due to harsh environments inside the combustor and strong optical interference from strong combustion emission in UV-Mid IR wavelength. To overcome these drawbacks, a compact and small borescope long-wave-infrared (LWIR) sensor is developed to achieve two-dimensional high-spatial resolution, high-fidelity thermal imaging of 2D surface temperature in gas-turbine engines, providing the desired engine component temperature distribution. The compactLWIRborescope sensor makes it feasible to promote the durability of combustor in gas-turbine engines.

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