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Abstract
In consideration of many a collection method of solar energy nowadays, the potential for competition and marketing depends on transform efficiencies of solar energy products, in spite of energy collection and transform ways, and practically has a concern in cost margins and competitive capability of solar energy industry. However, how to judge transform efficiencies of solar energy products relies on precise instruments and measurement techniques. Besides, the measurement ability of solar radiation can in fact demonstrate the national research power of solar energy industry. Especially, the international comparison of primary absolute radiometers reflects the national capability of measurement technology and laboratory quality chain. Not only solar energy industry needs the technology of primary absolute radiometer, but also opto-electronic industry much needs the technology primary absolute radiometer to calibrate standard light sources, so as to improve the accuracy of opto-electronic devices.
This study employed the 3D computer-aided-design software Solidworks to model each resistor-type temperature sensor. Then, the finite element analysis package COSMOS Floworks was applied to simulate solid temperature, heat flux, density, heat transfer coefficient, fluid temperature, and ambient temperature of each modeled resistor-type temperature sensor. By way of analysis and comparison to all simulated results, thickness 0.1mm of copper plate was found to be the best dimension for the resistor-type temperature sensors due to the better stability and ease for manufacturing. This research tried to seek the best way for low cost to manufacture the electric circuit of resistor-type temperature sensor. With the aid of electro-deposition process, the colorful dark films of ceramic property can resist corrosion and oxidation, and possess lower thermal emittance than the original copper plate due to the nonmetallic property in the matrix. After electro-deposition process, the micro-lithographic patterns made via the ordinary LIGA (Lithographie GalVanoformung Abformung) process worked well owing to the inert property of electro-deposition coatings to the applied photo-resistor. The excellent electric insulation and wear resistance of electro-deposition coatings coupled with the micro-lithographic process make much better process yield and throughput of resistor-type temperature sensors possible.
After the symmetrically differential sensing system was assembled, a sequential testing via an artificial light source was made, and the results were similar to those predicted theoretically from the literature. During testing, a guard ring has to be put around resistor-type temperature sensors to prevent the disturbance from the ambient, and the detection sensitivity can be raised.
This research applied the heat transfer control technology, heat transfer in-time monitoring technique

and micro-lithographic process to develop a primary absolute radiometer of controlled temperature for solar radiation detection. Because the cavities of most radiometer for solar radiation in the world work above the room temperature, this research developed the symmetrically differential sensing method which is different from the ways by other countries, so as to improve the sensitivity and energy resolution of the primary absolute radiometer. Thus, this domestically built primary absolute radiometer can compete with similar equipments of other countries.
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