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About the accuracy of thermal overhead line monitoring systems

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The transformation of fossil-fired electrical energy systems into more and more weather-dependent sys-tems requires the efficient use of existing grid infra-structures. In this context, the application of methods which make optimal use of the thermal loadability of overhead lines is advantageous from an economic and regulatory point of view. Worldwide, network opera-tors are starting to increasingly apply the concept of dynamic line rating, although the operating experience is low and successfully tested methods are relying on divergent approaches. The comparison and the evaluation of these approaches requires detailed ref-erence measurements of overhead line temperatures over time and space, which however are not available due to the extensive length of overhead lines and its associated local and temporal frequently changing weather conditions. In this presentation, a simulation environment providing a reproducible temperature reference with exact knowledge of space and time is presented. The simulation is based on an electro-thermal overhead line modelling approach, which en-ables the systematic examination of weather-based measurement systems as well as measurements relying on the continuous estimation of line impedance parameters with synchrophasors. In contrast to con-ventional direct temperature measuring systems, the aforementioned systems offer the advantage of mini-mal invasive integration into existing networks. Fur-thermore, a combination of these systems is presented. It is shown how this approach enables more flexible and more precise temperature measurements, than the original stand-alone systems.

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Demonstration of high efficient SiC betavoltaics for Ni-63 radioisotope battery

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Radioisotope batteries have several advantages compared to other chemical batteries in energy storage and life time. Among the various radioisotopes, pure beta-emitting isotopes such as Ni-63, Pm-147, and H-3 can be easily shielded for safety and have long half-life from several to a hundred years. The use of long half-life beta-emitting radioisotopes as a source of batteries seems to solve all inconveniences in recharging portable personal electronic devices, such as mobile phone, and enormous kinds of wireless computer peripherals. Unfortunately, the long life and high output power cannot be satisfied at the same time with betavoltaic batteries because the energy density of a radioisotope is inversely proportional to the half-life of the isotope. Thus a lot of effort has gone into increasing the conversion efficiency of betavoltaic batteries by using wide bandgap semiconductors. In this paper, we use wide bandgap SiC semiconductor for Ni-63 betavoltaic. The PIN SiC betavoltaic structure consists of low resistive (0.015~0.025 ohm-cm) n-type SiC substrate, low doped ($3.5x10^{15}/cm^3$) n-type SiC absorption layer, and highly doped ($1x10^{19}/cm^3$) p-type SiC layer. The thickness of the each layers are 500 µm, 20 µm, and 0.25 µm, respectively. The demonstrations of the SiC betavoltaic batteries are performed by using 17 keV electron beam, which energy is equal to the average energy of beta particles irradiated from Ni-63. Under the electron beam power of 11.9 µW (700pA@17keV), the betavoltaic shows a short circuit current of 1.02 µA, an open circuit voltage of 2.34 V and the maximum output power of 2.1 µW. Fill-factor of the device is 0.87 and the power conversion efficiency is as high as 17.5%. Also the demonstration of the Ni-63 mounted betavoltaic shows a short circuit current of 3.73 nA and an open circuit voltage of 1.97 V resulting a conversion efficiency of 7.9% and output power of 45.7 nW/cm^2 under incident radioactivity of 0.9 mCi Ni-63 beta-ray.

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