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A low-cost Thermo-Luminescence system for use with .NET computing environments

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Abstract content
   (Max 300 words)

Many branches of scientific and industrial research require precise instrumentation for control and measurement that tend to be prohibitively expensive. In the current global economic climate, the funding to procure such equipment is fast dwindling. Rather than face a gradual downturn in research activity as a result of equipment procurement difficulties, an alternative is to design and build low-cost instruments. Our current institutional interest in the synthesis and characterization of phosphors, polymers and nano-materials indicates a variety of instruments, one of which is the use of thermo-luminescence (TL) system. This instrument requires precise control and measurement of experimental parameters, particularly the sample excitation temperature and output intensity. In the present paper we describe the design and construction of an ultra-low cost TL instrument that allows automatic control of various steps of the experiment while logging instantaneous intensity output. We present preliminary results and indications that demonstrate the versatility for temperature sequencing, range and heating control of the sample over the temperature range of 23 to +400℃. A comparable instrument in the institution operates at a maximum ceiling of 300℃. Additional refinements enable the sample temperature to be held constant at any temperature in this range to within ± 0.5 ℃ with aid of a software tuned proportional-integral-derivative (PID) controller. Intensity measurements are made using a temperature compensated, large area photo-diode operated in photovoltaic mode and covering a wavelength range 400 nm to 1100 nm. The various interfaces such as the universal serial bus (USB) protocol handling, the Visual Basic.NET control program, the microcontroller firmware code written in the C-language have been developed simultaneously. A record of each experimental run is logged to a disk file in a format that allows direct import into spreadsheets and analysis programs. Finally, we draw comparisons between the final TL system and the existing commercial TL system for a number of standard reference samples.

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MSc

Main supervisor (name and email)
and his / her institution

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Yes

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