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Novel method for correction of thermal drift in nanoindentation experiments

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Nanoindentation is widely used for characterizing mechanical properties (Elastic modulus (*E*) and Hardness (*H*)) of materials at small length scales. Thermal drift effects during indentation are well-known, and are typically corrected by using a linear relationship between displacement and time. However, this method has serious drawbacks for measuring thermal drift for long duration experiments even at room temperature. We show that for experiments in displacement control (DC) mode, the conventional methods to measure thermal drift are inaccurate. Changes in value due to thermal drift occur in the load data, not in displacement data. In addition, we find variable thermal drift rate even for 100 seconds duration experiments at ideal ambient conditions (~ 22 ^{0} C, 45 % RH) for both load control (LC) and DC modes. Drift correction methods that require post-monitoring of displacement lead to errors since unloading behaviour is influenced by elastic response of sample being tested. Further, we show that drift value may vary from place to place due to small temperature variation across the sample. Hence, we propose a novel scheme that involves *prior drift monitoring* which should be done at each location of the sample before carrying out indentation to eliminate the effect of temperature.

Keywords: Nanoindentation; Drift correction; Quartz; Polycarbonate; Viscoelasticity

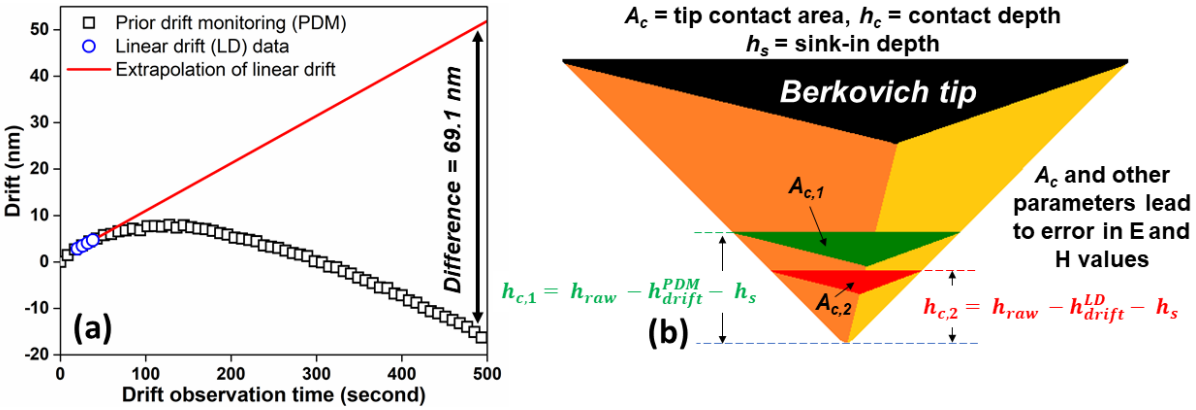

Fig.1 (a) Comparison between the drift values of PDM and LD and (b) schematic diagram shows the error in measurement of *E* and *H* values