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Committee E28 on Mechanical Testing
Subcommittee E28.06 on Indentation Hardness Testing

Research Report: E28-1045

Interlaboratory Study to Establish Precision Statements for ASTM E2546-15, Standard Practice for Instrumented Indentation Testing

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1. Introduction:

Interlaboratory Study 951 was conducted to establish a precision statement for E2546, Standard Practice for Instrumented Indentation Testing.

2. Test Method:

The Test Method used for this ILS is E2546-15. To obtain a copy of E2546, go to ASTM's website, www.astm.org, or contact ASTM Customer Service by phone at 610-832-9585 (8:30 a.m. - 4:30 p.m. Eastern U.S. Standard Time, Monday through Friday) or by email at service@astm.org.

3. Participating Laboratories:

The following laboratories participated in this interlaboratory study:

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4. **Description of Samples:**

There were 5 samples of varying targeted results used for this study. Each sample was supplied, prepared and distributed by Jennifer Hay of Agilent Technologies. After testing was completed at each laboratory, samples were shipped to the next laboratory on the testing schedule in a round robin format. Below is a list of the samples:

1. Fused Silica

2. Nano-crystalline nickel

3. Polycarbonate

4. Borosilicate Glass

5. Silicon 111

5. **Interlaboratory Study Instructions**
Laboratory participants were emailed the test program instructions. For a copy of the instructions, please see Annex A.

6. Description of Equipment/Apparatus[1]:
For information on the equipment/apparatus used by each laboratory, please see Annex B.

7. Data Report Forms:
Each laboratory was provided with a data report form for the collection of data. A copy of the data is provided in Annex C.

Please note: The laboratories have been randomly coded and cannot be identified herein.

8. Statistical Data Summary:
A summary of the statistics calculated from the data returned by the participating laboratories is provided in Annex D.

9. Precision and Bias Statement:

9.1 The precision of this test method is based on an interlaboratory study of ASTM E2546, Standard Practice for Instrumented Indentation Testing, conducted in 2014. Participants in six laboratories tested five different materials for both indentation modulus and indentation hardness at two distinct test forces. Every "test result" represents an individual determination, and all participants were asked to report five replicate test results for each material analyzed. All test results are in GPa units. Practice E691 was followed for the study design and analysis of the data; the details are given in ASTM Research Report No. E28-1045.[i]

9.1.1 *Repeatability limit (r)* - Two test results obtained within one laboratory shall be judged not equivalent if they differ by more than the "*r*" value for that material; "*r*" is the interval representing the critical difference between two test results for the same material, obtained by the same operator using the same equipment on the same day in the same laboratory.

[1] The equipment listed was used to develop a precision statement for E2546-15. This listing is not an endorsement or certification by ASTM International.