Ebatco Nano
A Bimonthly Newsletter

Nano **Brief**

ASTM International, Toronto, Canada, May 6, 2025
Ebatco's Dr. Lawrence Anderson will be presenting at the ASTM Workshop on the Characterization of Hydrogel Medical Products. This presentation will include a discussion of the experimental techniques that have been developed and implemented at Ebatco to address the characterization of hydrogel contact lenses. The inherent softness, hydrated nature, and low thickness of a hydrogel contact lens are crucial for user's comfort and wearability, but these aspects also make measuring materials properties challenging. With customized equipment and methods, we have achieved determination of meaningful results using friction, contact angle, and nanoindentation measurement techniques.

Pittcon, Boston, MA
Ebatco, represented by President, Dr. Dehua Yang, Vice President, Ms. Ming Li, and Analytical Chemist, Dr. Jason Scheeler, exhibited at the Pittcon Conference and Exposition in Boston on March 1-5, 2025. The Ebatco representatives were grateful to all of the booth visitors. They have enjoyed meeting with you and learning about your products and applications. We hope to have an opportunity to support your unmet material and device testing needs soon.

To keep pace with market needs, and to meet and greet our existing and potential customers continuously in 2025, Ebatco will exhibit in several additional regional and national conferences and exhibitions as listed below:

- April 22 – MN Insurance Alliance Trade Show, Doubletree West, Edina, MN
- April 25 – MMS Annual Spring Symposium: Correlative Microscopy, Minnesota Landscape Arboretum, Chaska, MN

- May 19-22 – Society for the Advancement of Material and Process Engineering (SAMPE), Booth #F9, Indiana Convention Center, Indianapolis, IN, representing Kyowa Interface Science Co. Ltd.
- September 28-October 1 – The Advanced Materials Show (USA), Booth #429, Greater Columbus Convention Center, Columbus, OH
- October 21-22 – MD&M Minneapolis, Booth #2528, Minneapolis Convention Center, Minneapolis, MN
- November 16-20 – ISTFA, Booth #408, Pasadena Convention Center, Pasadena, CA

Please put on your calendar and arrange time to visit our booth if you will attend any of the events. Our staff scientists and executives will be ready to discuss with you on how our ISO 17025 accredited lab services could provide solutions to your R&D, quality assurance and failure analysis challenges. We hope to see you soon!

Ebatco

Ebatco welcomes Dr. Jeff Kabel as our newest Analysis and Application Engineer.

Dr. Kabel received his Ph.D. in Applied Physics with a focus on nanoscale science and technology from Michigan Technological University. Throughout his undergraduate research at the University of Michigan, he studied the synthesis of various nanomaterials, including two-dimensional graphene and graphene oxide as well as quasi-one-dimensional silver/carbon and copper/carbon heterostructures. During his graduate studies, Dr. Kabel began searching for alternatives to cadmium selenide for active layer materials in novel photovoltaics, and he fabricated some proof-of-concept quantum dot solar cells based on molybdenum disulfide that rivaled early performances of similar CdSe devices (presented at MRS Fall Meeting 2020). The last few years of his doctorate were focused on the internal functionalization of nanotubes for optoelectronic and biomedical applications. Dr. Kabel developed a method to confine organic dye inside of boron nitride nanotubes and demonstrated that this significantly improved the photostability of the dye which could enable long exposure bio-imaging applications (APS Spring 2024). Dr. Kabel has been characterizing materials using various

techniques for the past 9 years, and he is eager to put his knowledge, expertise and experience to use so as to better support Ebatco customers in nanomaterials, microscopy, spectroscopy and surface science fields.

Case Study

Shore Hardness of Household Materials

Every day, getting up and going about our daily business is essential to having a good day. Then, have you ever considered the importance that materials like elastomers, plastics, or fibers have on our daily routine? Clipboards, erasers, rubber tires, and shoe heels are examples of materials in which possessing the proper hardness is critical to its function. If a clipboard is too soft, it will bend during use making writing on it impossible. Erasers need to be soft enough to remove graphite from paper without destroying the paper, yet hard enough to retain its shape when used. Shoe heels need to be hard enough to protect your feet and to support your body, yet flexible enough to allow for comfortable walking.

What kind of testing would be ideal for determining this kind of hardness? The time-tested method turns out to be Shore hardness testing. Shore hardness is performed using an instrument called a durometer. A durometer consists of a probe tip made of hardened steel attached to a force spring and read out gauge. An image of a Shore D durometer is shown in Figure 1.

Figure 1. Image of a Shore D durometer.

When the probe tip is pressed into a sample, the force spring will compress. This compressed displacement, combined with the known stiffness of the spring and indenter tip geometry, allows

for a hardness value to be calculated and displayed on the read-out gauge. Shore hardness is often designated by a letter or letters of the alphabet to indicate what type of probe is being used. For example, Shore A uses a truncated cone with a flat bottom while Shore D uses a sharp, non-truncated cone. Choosing which scale to use depends on the hardness of the material. If the material is soft like an elastomer or silicone, then Shore A would be appropriate. If the material is stiff like vulcanized rubber or cross-linked epoxy, then Shore D would be appropriate. Each scale covers only a certain range of material hardness and if a recorded value is at the extreme high or low ends of the scale, a different scale should be used in order to obtain accurate results.

To demonstrate the usefulness of the Shore hardness testing, five household materials were tested and reported in this application note. The tested materials are: packing foam, rubber eraser, leather belt, the heel of a dress shoe, and cured epoxy. These materials were chosen because of their ubiquity, household utility, and range of hardness values. Five measurements were taken on each sample with the average results shown in Figure 2.

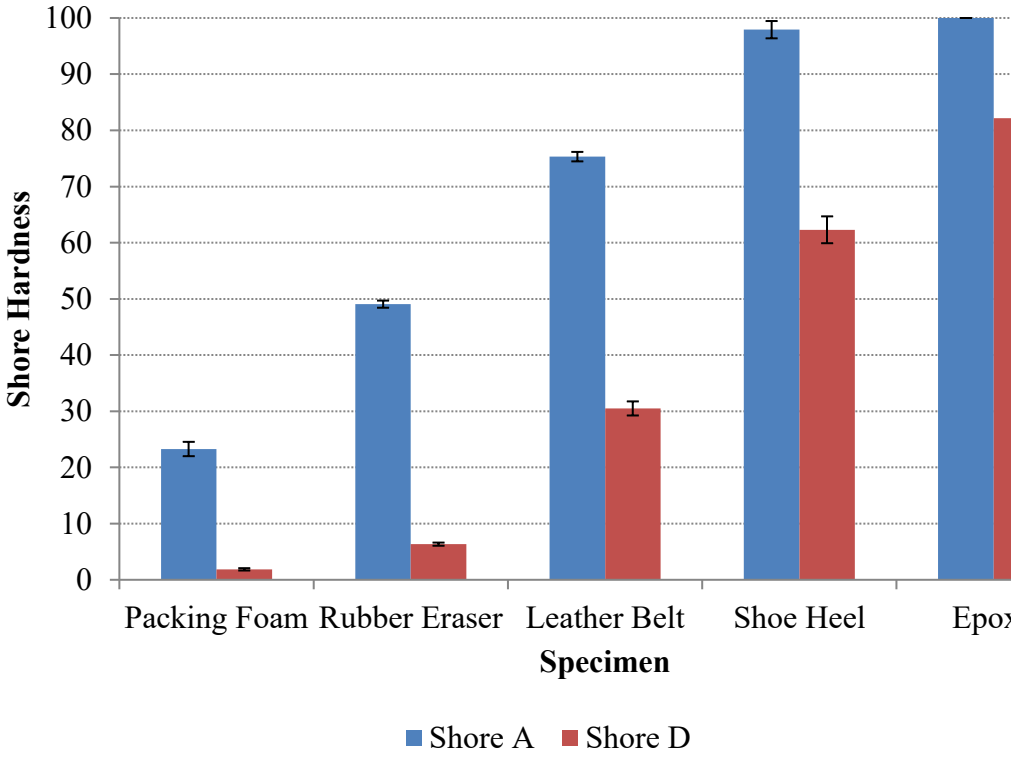

Figure 2. Average Shore A (blue) and Shore D (red) hardness measurements of
packing foam, rubber eraser, leather belt, shoe heel, and cured epoxy.

From Figure 2, it can be seen that every tested specimen had a value for Shore A and Shore D hardness with standard deviations, except for epoxy. The epoxy sample maxed out the Shore A durometer, which resulted in a Shore A hardness value of 100. Due to this phenomenon, another scale of shore hardness measurement should be made in order to precisely characterize the cured epoxy just as it was done here using Shore D testing. It is also interesting to note the extremely low Shore D hardness value determined for packing foam specimen. The average Shore D value for this specimen was 2, which is low enough to warrant another scale measurement to better quantify its hardness value. All of the other household material samples had intermediate and different values of Shore A and Shore D hardness, which are in excellent agreement with our intuitive impressions for the hardness of these materials from their intended household utilities.

In summary, Shore hardness is a quick and easy measurement and verification tool that can be used to evaluate material hardness for specific applications. For instance, Shore hardness can serve as a benchmark to the extent of polymer curing or as a gauge value to decide whether a material is suitable for floor mat or shoe sole applications. Because the extent that soft, rubbery, plastic and polymeric materials are used in everyday life, easy and reliable test methods like Shore hardness are required to ensure that these materials are suitable for the intended consumer use.

Ebatco, 10025 Valley View Road, Suite 150, Eden Prairie, MN 55344, USA
+1 952 746 8086 | info@ebatco.com | www.ebatco.com