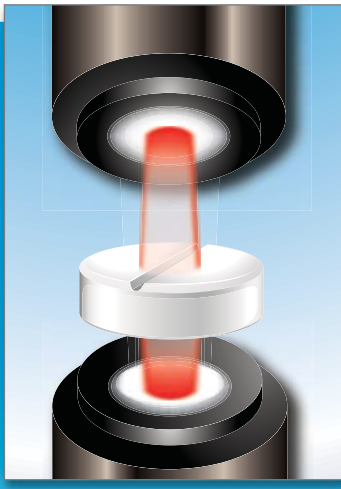


Non-Destructive Hardness Testing

Leaving Traditional Methods in the Dust



Advantest's TAS7500 System

Makes Tablet Hardness Analysis Simpler, Faster and More Precise

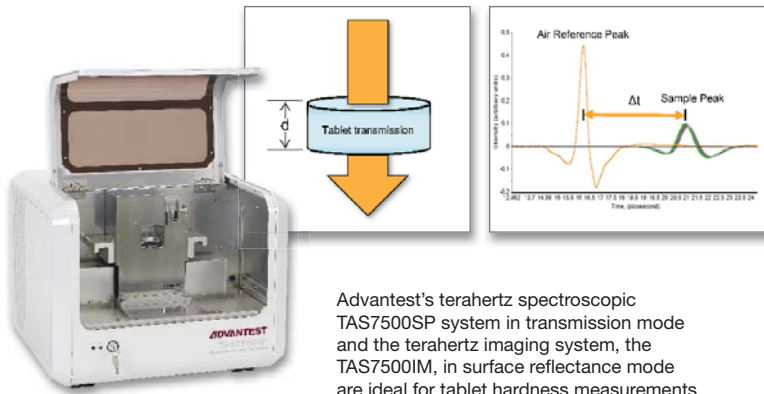
Tablet hardness testing plays an important role in pharmaceutical product development and quality control. In the race to streamline tablet hardness analysis, Advantest combines speed, simplicity and increased precision with innovative and non-destructive terahertz (THz) metrology.

Terahertz: Streamlining tablet hardness testing and improving accuracy

Advantest's spectroscopy and imaging systems employ proprietary terahertz technology to address the needs of manufacturing. THz spectroscopy evaluates tablet hardness and other attributes such as layer thickness in milliseconds where traditional hardness testing just measures tensile strength. Terahertz transmission spectroscopy and imaging are non-contact and non-invasive methods that avoid harmful radiation, which can alter or heat samples.

Terahertz analysis also extends production advantages by preserving the tablet sample for additional testing, an important benefit when costly drugs are involved.

Advantest's instruments can be employed on-line or at-line, offering the adaptability to enhance efficiency throughout manufacturing, as well as in the QC and R&D laboratories.



Advantest's terahertz spectroscopic TAS7500SP system in transmission mode and the terahertz imaging system, the TAS7500IM, in surface reflectance mode are ideal for tablet hardness measurements of bulk materials and offer benefits over conventional destructive tablet hardness methods.

Terahertz Spectroscopy & Imaging Advantages	
Non-Destructive	<ul style="list-style-type: none"> Samples are preserved, allowing for additional testing, such as dissolution and crystallinity.
Non-Invasive Non-Contact	<ul style="list-style-type: none"> Terahertz is non-ionizing radiation, which will not compromise the integrity of the sample.
Fast Analysis	<ul style="list-style-type: none"> Milliseconds per tablet; suitable for online applications.
Exacting Results	<ul style="list-style-type: none"> Terahertz analysis demonstrates a linear relationship between tablet density and bulk refractive index measurements. The coefficient of linearity value, R², is 0.9899 for a wide range of compaction forces.
Better Insight	<ul style="list-style-type: none"> Terahertz can be used to reveal internal defects, such as cracks and voids, that otherwise would not be detected using a traditional mechanical crushing method.

Terahertz Tablet Hardness Testing Solutions

THz RI and Tablet Density/Hardness Measurements

Four sets of 10 tablets were made from a multi-component placebo formulation and the powdered mixtures were compacted into 6.5 mm diameter flat-faced tablets at four different compaction forces: 3.0, 4.4, 5.5 and 8.0 kN. Due to the non-destructive nature of the THz technique, the samples were initially analyzed using terahertz spectroscopy and imaging. Then hardness testing was performed on the same tablets.

Bulk THz refractive index measurements are related to tablet hardness as shown in Figure 1. The individual tablets were analyzed non-destructively by THz transmission followed by hardness testing. The bulk RI measurements by THz spectroscopy directly probe the densification of the tablet powder under pressure that is responsible for hardness. The excellent correlation between THz refractive index and hardness attests to the high precision of the THz measurement.

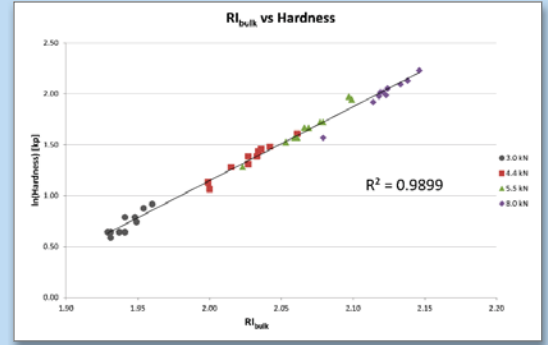


Figure 1

THz Surface RI Spatial Density Maps Exhibit Superb Tablet Density/Hardness Correlation

THz imaging provides an alternative means to measure tablet hardness with spatial sensitivity. In contrast to THz transmission where the beam probes a wide area all at once, the imaging beam is focused to a small spot size and the surface is mapped by moving the tablet stepwise. The results of THz XY line mapping of surface RI on flat faced tablets prepared with varying compaction force are shown in Figure 2.

The spatial maps provide information that is especially important for comparing the hardness distributions of different tablet shapes.

An average surface RI value can also be obtained from the individual imaged pixels and this can be compared to whole tablet hardness as shown in Figure 3.

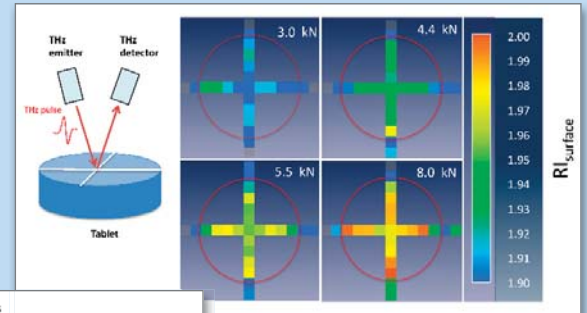


Figure 2

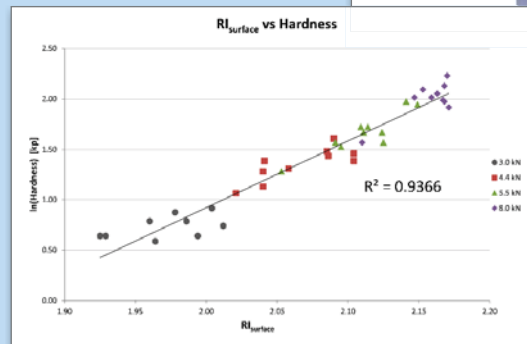


Figure 3

Figure 2. Terahertz surface spatial density maps vs. tablet hardness at various compaction forces.

Figure 3. RI_{surface} vs. tablet hardness at several compaction forces.

Conclusion . . .

Terahertz transmission spectroscopy and imaging are non-destructive alternatives to traditional tablet hardness testing that also provide detailed spatial information related to tablet shape. After THz hardness measurements, the same tablets can be used for disintegration or dissolution testing. This allows one to evaluate and compare tablet hardness properties with other attributes, such as dissolution results, which is not possible with a mechanical crushing method in which tablets are destroyed. These characteristics, coupled with the ability to make accurate determinations of tablet bulk and surface RI, make terahertz a viable method for on-line, at-line or in-line monitoring of tablet compaction during pharmaceutical manufacturing.

On-Line, Non-Contact Weight Measurements Too

With knowledge of tablet geometric dimensions and THz-calculated density, terahertz spectroscopy is ideal for on-line, non-contact tablet weight measurements.

Contact Advantest Today to Learn More

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