

# SOLID STATE NUCLEAR TRACK DETECTORS MADE FROM CR-39® MATERIAL

With the growing awareness of health hazards from naturally occurring radon, and with greater importance being given to detecting radiation in medical, industrial and research environments, experts increasingly are turning to solid state nuclear track detectors (SSNTDs) to determine neutron doses and measure radon concentration. These powerful yet simple scientific tools measure the number of tracks produced by neutrons and alpha particles to give an accurate assessment of radiation dose and radon exposure.

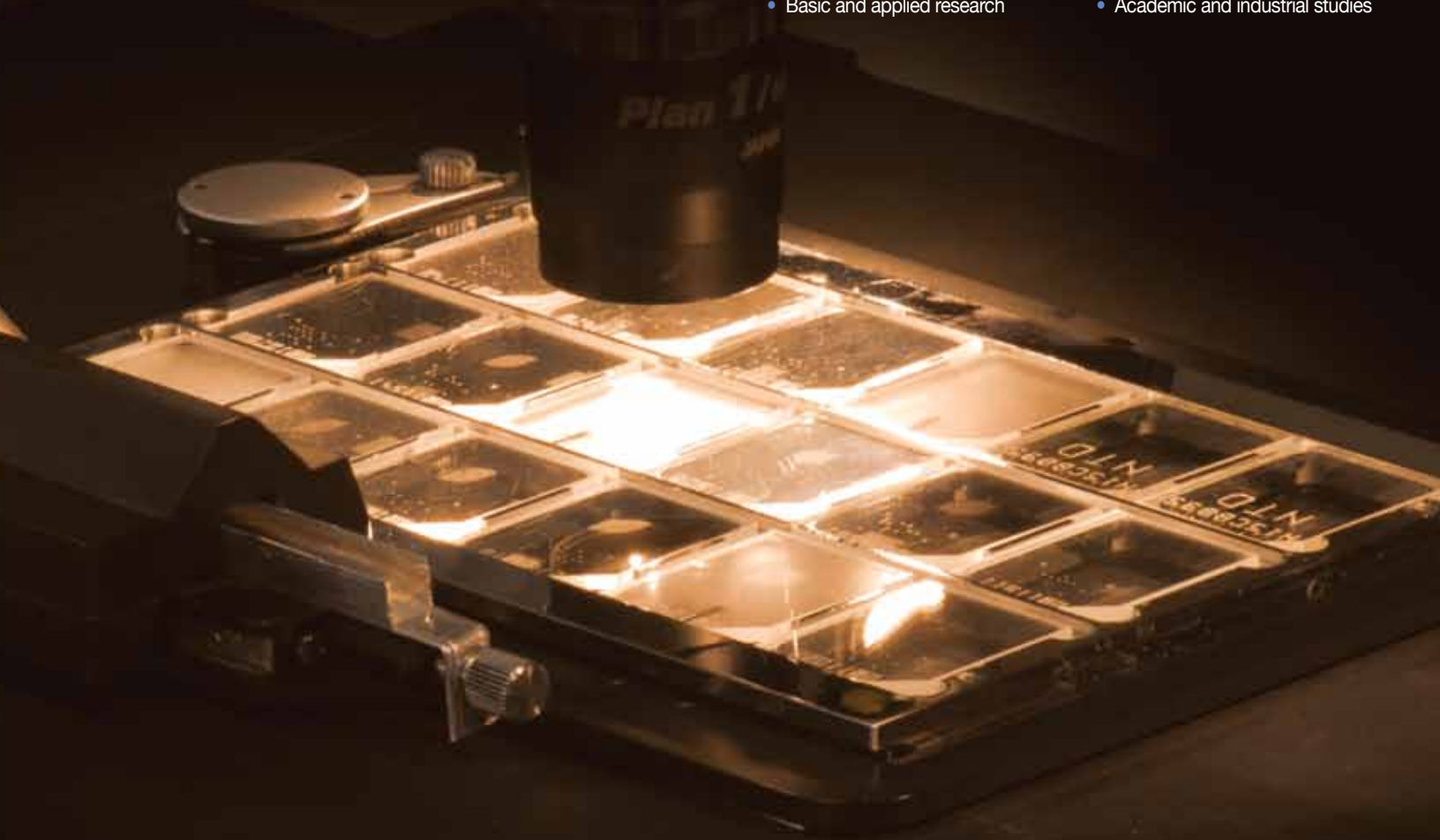
The most critical component of an SSNTD is the substrate material, and the most definitive SSNTD substrate material is **CR-39®** material from Engineered Sheet Products. ESP technicians control the entire production process for SSNTDs made with **CR-39®** material—from formulation onward. This vertical integration allows for customized sheet production and tight controls on the quality during production.

## ADVANCED PERFORMANCE

- Provides a highly sensitive substrate that reveals detailed information for individual particles.
- Offers consistent material batches with low background tracks.
- Does not degrade, allowing for analysis at a later date. Measures over long periods of time, resulting in a more accurate reading compared to short-term monitoring.
- Enables simple, robust and inexpensive device construction that does not require complicated hardware or software.
- Produces permanent particle damage—nothing gets lost or averaged away.

## APPLICATIONS

- Radon detection
- Autoradiography
- Cosmic radiation
- Basic and applied research
- Neutron dosimetry
- Positron emission tomography
- Dosimetry products
- Academic and industrial studies



## CR-39® MATERIAL ADVANTAGE

**CR-39®** material for SSNTDs is a specially formulated, clear, colorless sheet that is highly sensitive to the tracks of neutrons, protons, alpha particles and other charged and uncharged particles. This extreme sensitivity produces permanent particle damage and allows for detailed information, such as mass, charge, energy and direction, to be gathered for individual particles.

While other measurement methods sample radon concentration over very short periods of time, the age-resistance of SSNTDs made with **CR-39®** material permit measurement over long periods to include short-term fluctuations, greatly increasing the accuracy of the reading exposure amounts. Sheets made from **CR-39®** material also do not degrade, so detectors can be archived and analyzed at a later date.

## INNOVATIVE TECHNOLOGY

A particle coming into contact with a detector made from **CR-39®** material damages the material as it passes through and leaves a permanent trail, known as a track. Tracks can be observed and counted using a microscope once the detector is removed from the device and exposed to a caustic solution to enlarge the conical pits left by particles. This safe and simple process is known as etching.

The shape and size of each track provides additional information for specific particles. For example, a particle's energy level can be calculated by the size of its track. The direction from which the particle hit the sheet can be seen in the track's circular or elliptical shape at the point of contact.

This high level of visual detail—along with accuracy, simplicity and cost-effectiveness—is why SSNTDs made from **CR-39®** material are leaving their own mark on the industry.



Microphotograph of particle tracks in CR-39 material from <sup>222</sup>Rn decay.  
Courtesy of INFN Bologna.

## ADVANCED SOLUTIONS, DESIGNED AND ENGINEERED

ESP Engineered Sheet Products is a leading provider of high performance optical sheet solutions that are engineered to be lightweight, age and chemical resistant, mechanically durable and, above all, optically superior.

## ENGINEERED SOLUTIONS

ESP offers design versatility through a wide range of standard and customizable product options.

- High-purity grade
- Finishing capabilities include engraved serialization codes
- Cut to any shape or size using a computer controlled laser
- Mechanical properties that can be varied to meet customer specifications



## STANDARD AVAILABILITY

### DIMENSIONS

[ Tolerances: ± 0.1 mm ]

- Custom sizes up to 620 mm

### THICKNESS

[ Tolerances: ± 5% of nominal value ]

- 0.7 mm ; 1.0 mm ; 1.5 mm



## BULK ETCH VELOCITY

Bulk etch rates (vB) of SSNTDs from **CR-39®** material vary depending on the etching parameters. Here are examples of etching solution, temperatures and velocities used by some of our customers.

NaOH WATER SOLUTION	TEMPERATURE ( °C )	BULK ETCH VELOCITY (um/h)
6N	40	0.100 +/- 0.002
6N	70	1.20 +/- 0.02
8N	80	4.20 +/- 0.21

When etched in an aqueous solution of sodium hydroxide (NaOH) or potassium hydroxide (KOH) at different temperatures and normalities, the post etch surface of the SSNTD has a fine transparency, enabling easy track counting.

## BACKGROUND

ESP manufactures SSNTD sheets to have an extremely low background with high and consistent sensitivity to particles.

## STORAGE

SSNTD sheets are sealed in aluminum bags filled with dry air and stored at about -20°C.



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