

Tracks in CR-39

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1 What is CR-39

CR-39 (Columbia Resin #39) is a lightweight, impact-resistant plastic polymer. It is a thermosetting plastic derived from allyl diglycol carbonate (ADC) monomers.

When the ADC monomer ($\text{C}_{12}\text{H}_{18}\text{O}_7$) is polymerised, the CR-39 structure contains allyl groups ($-\text{CH}_2 - \text{CH} = \text{CH}_2$) and carbonate ($-\text{COO}-$) functional groups.

2 Radiation detection

2.1 Charged particles

When high-energy charged particles (e.g., alpha particles, protons, or heavy ions) pass through CR-39, they break chemical bonds along their path, creating latent damage tracks in the polymer. These tracks are invisible initially but weaken the polymer structure at those points. The tracks can be made visible through an etching process.

When the exposed CR-39 is submerged in a chemical etchant (usually 6M NaOH or KOH at 60–70°C), the etching solution dissolves the damaged regions faster than the undamaged areas, making the tracks visible under a microscope. The resulting track diameter and shape provide information about the energy and type of radiation.

2.2 Neutrons

Although not charged, neutrons can be detected by CR-39 through an indirect mechanism.

Proton Recoil (Elastic Scattering) - most common

Secondary Reactions with Carbon or Oxygen - less common

Fission fragments with contaminants

2.2.0.1