

# DuPontä

## Nafion® PFSA Products

perfluorosulfonic acid polymer

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### Chemical Treatment of Nafion® PFSA Resins R-1100 and R-1000

DuPont™ Nafion® PFSA Resins R-1100 and R-1000 are the perfluorinated precursor resins in the sulfonyl fluoride (-SO<sub>2</sub>F) form. In this form the polymer does not have the cation-exchange properties like other Nafion® PFSA Products, and must be chemically treated to make it suitable for use in cation-exchange applications. After chemical treatment as described below, the polymer will be in the potassium salt form (-SO<sub>3</sub>K), or the acid form (-SO<sub>3</sub>H). Other forms may be obtained by soaking the polymer in the appropriate salt solution.

As precursor resin, R-1100 and R-1000 are thermoplastic and can be easily melt extruded into a variety of shapes before chemical treatment. In addition, resin in the sulfonyl fluoride, salt or acid form can be bonded to itself or certain other materials through a heat-sealing process.

The chemical treatment involves several process steps, and the reaction rates are controlled by the concentration and temperature of the solutions in the chemical treatment baths. The process uses hazardous and corrosive chemicals and requires suitable safety and waste handling procedures.

### Chemical Treatment Steps

Nafion® PFSA Resin or Film is converted to the salt (K<sup>+</sup>) and acid (H<sup>+</sup>) forms by using the following processes:

#### Hydrolysis Process

The resin is hydrolyzed in a solution of 15% KOH / 35% DMSO / 50% de-ionized (DI) water at 80°C for a time period of 30 minutes to several hours, depending on the thickness of the resin pellet or film. Afterwards, the resin must be thoroughly washed with DI water. This should be done several times, by soaking the resin in room temperature DI water for at least 30 minutes, then renew the water and repeat at least two additional times to remove all traces of un-reacted KOH. The Nafion® PFSA Resin is now in the K<sup>+</sup> form.

#### Acid Conversion Process

The hydrolyzed resin can be converted to the H<sup>+</sup> form by exchanging the K<sup>+</sup> for H<sup>+</sup> ions using a 10 to 15% solution of nitric acid (HNO<sub>3</sub>). Since this is an "equilibrium" exchange, this step should be repeated at least twice with fresh Nitric Acid, including a fresh DI water rinse after each acid treatment.

Note: All solution concentrations are on a percent *weight basis*.



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## Safe Handling and Use of Nafion® PFSA Membranes

The following information should be reviewed before handling and processing Nafion® PFSA Membranes:

- DuPont Material Safety Data Sheet for Nafion® PFSA Membranes
- Nafion® Technical Information "Safe Handling and Use"
- "Guide to Safe Handling of Fluoropolymer Resins", Third Edition, June 1998, Published by the Fluoropolymers Division of the Society of the Plastics Industry, Inc.

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### For more information about Nafion® contact:

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**Caution:** Do not use in medical applications involving permanent implantation in the human body. For other medical applications, see "DuPont Medical Caution Statement", H-50102.



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