A rapid technique was developed to measure fluorine incorporated into the inner surface of polyethylene containers during blow-molding. The analysis was based on the $^{19}F/n,\gamma^{20}F$ reaction. Results indicate that fluorine concentrations greater than 1 $\mu$g F/cm$^2$ can be measured on areas as small as 1 cm$^2$.

INTRODUCTION

High density polyethylene gasoline tanks are blow-molded with gaseous nitrogen. Various levels of fluorine gas /1 to 2%/ can be mixed with the nitrogen in order to form a polytetrafluoroethylene layer on the interior surface of the tank. The layer reduces the permeability of the interior surface to hydrocarbons and thus decreases fuel loss. A value of 45 $\mu$g F/cm$^2$ has been established as the minimum level of fluorination to pass permeation tests.

Fluorine levels on the treated surfaces have been measured previously by specific fluoride ion electrode
after sample combustion\(^1\), or by colorimetric and gravimetric procedures\(^2-6\). The specific ion electrode method avoids many interference problems associated with the other techniques, but is time consuming, temperature sensitive, and subject to sample loss during combustion.

A neutron activation analysis technique for the \(^{19}\text{F}/n,\gamma/^{20}\text{F}\) reaction was ideal for these samples, since there would be no matrix interference problems from the polyethylene and possible trace contaminants in it. The amount of fluorine was directly proportional to the activity of the 1634 keV \(\gamma\)-ray produced by decay of \(^{20}\text{F}\) with a half-life of 11.0 sec. /\(^{19}\text{F} 100\%\) abundance, \(\sigma_C = 0.0096\) barn, 1634 keV \(\gamma\) /100%/.

**EXPERIMENTAL**

Three sections of blow molded polyethylene /Philips 5100 high density polyethylene/ gasoline tanks were obtained. One of the sections was from an untreated tank, the other two sections were from tanks molded with either a high or low level of fluorine gas mixed with nitrogen. Disks 5/16 inches in diameter were punched from each section. Ten duplicate samples from each section were packaged two disks to a polyethylene sample vial /3/8 inch i.d., 1 inch height/, with the treated surface of the polyethylene facing upward. A small crumpled piece of thin polyethylene sheet, inserted on top of the disks, held the samples in place.

A set of standards ranging from 0 to 60 \(\mu\)g F was prepared from disks of the untreated polyethylene and of filter paper /Whatman \# 5/. These standards were assembled by placing a polyethylene disk into a sample vial, placing a filter paper disk on it, and micro-