

In another AEC study a laboratory-type Mossbauer spectrometer is being developed to determine the structural characteristics of iron and steel products. For example, analyses of specimens of bearing-type steel subject to varying heat treatments and containing varying levels of retained austenite have shown that the Mossbauer technique provides quantitative measurement of the austenitic phase in agreement with values determined by X-ray diffraction measurements. We are also exploring other potential uses of the Mossbauer scattering technique for determining the volume fractions of iron phases in multi-phase mixtures. Preliminary data indicate that this technique can follow austenite transformation, cementite precipitation, and tempered martensite production in heat-treated high-alloy high-speed steels, cold-worked medium-alloy die steels, and aged maraging steels. In addition, the scattering method provides a convenient nondestructive method for detection and identification of surface compound formation in iron corrosion studies. The Mossbauer technique should prove applicable to a variety of industrial problems.

In still another project we are investigating isotopic methods for measuring the cement content of concrete. An important problem in civil engineering is the quality control of concrete. Quality is based on the strength of the concrete, which can be directly measured only after setting and curing. The strength of concrete is related to the cement and water content and to the bulk density and air entrainment factor of the wet mix. Although methods are available to determine water and air content and bulk density, no satisfactory method for measuring cement content has been found. Preliminary tests using low-energy gamma-ray backscatter techniques, however, have indicated that this method can measure cement content within 1% in only 10 seconds. These results were obtained using a 1-millicurie americium-241 source.

Environmental protection

As our world becomes more crowded, industrialized, and polluted, industry is finding itself more and more concerned with matters involving environment and conservation. Radioisotopes and radioisotope technology offer unique contributions to our understanding of these increasingly vital areas.

Before legal and technical aspects of air-pollution-control efforts can be effective, there must be a way to measure the gas pollutants,