Manufacturing and Testing

Radiation is used to measure and in some instances control the thickness of some manufactured materials such as plastics, paper, and photographic films. In these applications, the detector compares the attenuated radiation signal with the unattenuated signal to determine the thickness of the material.

One particular application now in use commercially is the detection of cracks and flaws in critical metal components such as jet aircraft turbine blades. In this case krypton-85 is sorbed on the surfaces of microdefects. Interaction of the krypton ß particles with a sprayed-on emulsion coating makes the defects visible. This technique has been shown to be particularly effective in detecting hot tears, microshrinkage, and microcracks in turbine blades.

Tracer Applications

Radioactive tracers have been widely used for decades in research. Because there are radioactive isotopes of all of the elements, suitable radioactive tracers with the same chemical properties as those of the nonradioactive element can be found for most reactions of interest. More recently, the use of tracers has expanded into manufacturing and industry. These radiotracers can be added to various solutions to indicate when mixing is complete; they can also be used to indicate wear, detect leaks in a pipeline, trace the movement and distribution of nutrients in plants, and in numerous other applications currently in use or yet to be conceived.

SUPPLY AND DEMAND OF RADIOISOTOPES

It should be evident from the examples given above that the applications of radioisotopes is almost unlimited and will continue to grow as imaginative scientists and engineers conceive solutions to the myriad of problems in research and industry. At the same time there is a need for a comparable effort to assure the continuing availability of the needed isotopes. There are a variety of sources which are more thoroughly discussed in other papers in this session. Some such as cesium-137, strontium-90, and krypton-85 are fission products produced in nuclear reactors. These become available when separated from the other materials in the processing of irradiated reactor fuels to produce fissionable materials for the weapons program. Much larger quantities are present in the higher-burnup fuels from commercial power reactors. However, these are not generally available at a reasonable cost because power reactor fuel is not currently being processed in the U. S. Other radioisotopes, most notably cobalt-60, is produced as a byproduct of power reactors by activating a suitable target during reactor operation. A large number of isotopes have been produced in isotope production reactors or in production facilities in test reactors. The potential for production in these facilities has only begun to be tapped. Another source of isotopes is by the use of particle accelerators. Many of the short lived isotopes, especially for medical use, must be produced in small accelerator facilities at the location of use.

SUMMARY

In summary, the applications of radioisotopes is extensive and increasing. There is a growing need for further applications development and production. Many current applications could better be met by other isotopes with more optimized