Using PIXE and PIGE for Elemental Composition Analysis

PIXE (particle induced x-ray emission) and PIGE (particle induced gamma-ray emission) are complementary ion beam analysis (IBA) techniques used to study elemental composition. Using 1 μCi of ^{133}Ba, ^{57}Co, and ^{241}Am, the calibration of two detectors: CdTe (x-ray and -ray detector) and Si-PIN (x-ray detector) were conducted. To identify unknown photopeaks observed by the CdTe detector, an energy (keV) versus atomic number (Z) curve was established through the spectral analysis of ^{29}Cu, ^{73}Ta, ^{50}Sn, ^{35}Br, ^{57}Co, and ^{133}Ba. Upon completion of the calibration of both detectors, four samples were analyzed in air and vacuum using a 9.5 mCi ^{241}Am alpha source to excite the x-rays on each sample. Based on the background, the limits of detection were computed and the samples were analyzed for the presence of Fe and Ni in a sample, success in eradicating Al from a raw versus treated sample and identification of O in a carbonized sample. In addition, an analysis of a PIGE experiment performed with the K150 cyclotron at Texas A& M using a 3.6/6.3 MeV proton beam was conducted to study the presence and concentration of fluorine in consumer products.