Advance Trends in Corrosion Monitoring: Thin Layer Activation (TLA) Technique

Corrosion has always been an unavoidable part of petroleum refining industries. It varies widely with different processes and depends on the nature of constituents in the process stream and operating process conditions. During processing, heavy and acidic crude oils impacts the refinery equipments in the form of corrosion; resulting in unscheduled refinery-shutdowns. Corrosion monitoring is invariably required to test and prove operational reliability. However, the conventional methods show their weakness in case of low accuracy, precision and sensitivity in performing the result of measurement. In hydrocarbon systems, it is very difficult to monitor slow corrosion rates using conventional corrosion monitoring techniques during stipulated period.

Thin Layer Activation (TLA) technique involves a high energy ion beam from an accelerator used to irradiate metal and measurements of corrosion or erosion can be carried out by monitoring drop of radioactivity under corrosive environment. Preliminary laboratory study has been carried out to estimate the corrosion behavior of stainless steel 316 L (SS 316L) in presence of chloride ion. The SS 316L coupons were labeled with small amount of radioactivity by irradiating with 13 MeV proton beam from an accelerator. The coupon was immersed in different concentration of hydrochloric acid solution to carryout corrosion measurements. At certain time intervals the activity loss was monitored by using a NaI(Tl) scintillation detector assembled with multichannel analyzer. The reduced activity was correlated with thickness loss by generating a calibration curve.

While applying Thin Layer Activation (TLA), to develop the corrosion monitoring technique for carbon steel (CS), alloy in hydrocarbon environment at high temperature; different CS, coupons were irradiated with a 13 MeV proton beam to produce Cobalt-56 radioisotope on the surface of the coupons. The corrosion studies were carried out by subjecting the irradiated coupons to a corrosive environment, i.e, uninhibited straight run gas oil (SRGO) containing known amount of naphthenic acid (NA) at high temperature. The effects of different parameters, such as, concentration of NA, temperature and fluid velocity (rpm) on corrosion behavior of CS were studied.