Abstract

Outlet manifold is functioned as gas collector of reforming process from catalyst tube through pigtail outlet and channeled into secondary reformer through a transfer line in the primary reformer. Manifold is operated on $817^\circ C$ and 3.2 MPa. It designed to use for 100,000 hours or 11.4 years. However, the failure of outlet manifold happened only 2 years since it has been installed. The failure consists of cracks and bulges. Therefore, the failure of outlet manifold is investigated to know the cause and mechanism in order to minimize the same failures in future.

The research is started with material analysis through chemical composition test, microstructure, XRD, and hardness test of the manifold. The surface of crack is analyzed transversely in macro and micro. The tests result indicates the Super Incolloy 800 HT material based has yield strength at 170 MPa and UTS at 450 MPa.

From the analysis result, the failure of manifold is caused by thermal fatigue. Crack passed and cut the grain
boundaries and get worse by often shutdown-startup, corrosion by product existence, and operating design in steam environment. Crack initiation probably occurred in working process. Combination of high service temperature and shutdown-startup frequency caused crack on the manifold. Crack initiation started from the surface and spread transversely to the deep.

**Keyword**: Outlet Manifold Primary Reformer, Failure Analysis, Thermal Fatigue.