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Failure Analysis and Manufacturing of Manganese Aluminum Bronze Propeller

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The Cycloidal Drive or Voith Schneider Propellers (VSP) are made from 8Al-8Mn-Cu manganese aluminum bronze (MAB). This type of propeller is widely used in the ship with safety and extreme maneuverability requirements. On the Cycloidal Drive, the rotor is mounted below the ship's hull and rotate about a vertical axis. A circular array of the blades project vertically from the rotor and simultaneously pivoting around their own axes to create angle of attack (AoA) which sync with the rotation of the rotor and generates lift at various direction and magnitude. The resultant force of all blades can be generated freely in any direction. Anyway, one of Thailand's ship is prone to propeller blade break down at the root of the blade due to dealloying of 8Al-8Mn-Cu Manganese Aluminium Bronze (MAB). This work is aimed to study root cause of failure of Manganese Aluminium Bronze (MAB) propeller and manufacturing of new propeller blade in Thailand. The results revealed that the propeller broke due to dealloying. Beta-phase was a corrosion onset site or anode as it contained larger amounts of, highly reactive metals, aluminium manganese and nickel than alpha-phase. Since these reactive metals were leached, copper was left behind. This phenomenon led to alteration of electrochemical potential thereby the beta-phase turned to be a cathode causing of corrosion propagation to alpha-phase. The Cycloidal Drive apply fatigue load on the propeller therefore dealloying areas which have low strength is susceptible to crack and brake later. Reverse engineering process is used to produce new propeller blade by scanning old blade profile using laser scan. Tile casting technique was used to cast propeller blade. By slowly tile the mold, liquid metal will enter to mold without turbulence which minimize oxide formation. After casting, propeller was machined using CNC to obtain precise blade profile. Nondestructive technique was used to check discontinuity of propeller. Also, propeller was subjected to heat treatment to minimize magnetic property. Five propeller blades of this project and five propeller blades of maker were installed and compared commissioning test for 1 year. The result results revealed that both blades of this project and that of maker have the same properties.