IAF SPACE PROPULSION SYMPOSIUM (C4)
Interactive Presentations - IAF SPACE PROPULSION SYMPOSIUM (IP)

Author: Dr. ACHUTANANDA PARHI
Indian Space Research Organization (ISRO), India, achyutaparhi@gmail.com

Mr. V MAHESH
Indian Space Research Organization (ISRO), India, v_maheshnair@yahoo.com
Mr. Eswaran V
Indian Space Research Organization (ISRO), India, v_eswaran@vssc.gov.in
Mr. Levin G
Indian Space Research Organization (ISRO), India, g_levin@vssc.gov.in
Mr. THOMAS C R
Indian Space Research Organisation (ISRO), SDSC SHAR, Astronautical Society of India, India, cr_thomas@vssc.gov.in
Mr. Rajarajan A
Vikram Sarabhai Space Centre, ISRO, Thiruvananthapuram, India, a_rajarajan@vssc.gov.in

RADIOGRAPHIC INSPECTION AND ANALYSIS OF CASE BONDED SOLID ROCKET MOTOR DEFECTS

Abstract

Solid rocket propellant is a particle-filled elastomer typically comprised of ammonium Perchlorate particles (oxidizer), aluminum particles (fuel), and synthetic rubber or plasticized polymer (binder). Propellant and interface defects in solid rocket motors like cracks, voids, air pockets, debond, separations, foreign inclusion and other similar types of flaws will severely affects the ballistic performance and may lead to catastrophe. Therefore, the detection of all such defects by using non-destructive testing (NDT) is highly essential to ensure the satisfactory performance of the motor during operation. Radiography is one of the most versatile quality assurance tools to build up the confidence of the article. Several other NDT techniques are used for detection of the defects, however radiographic techniques is highly deductive, detective and concise in comparison to other techniques. Radiographic method is based on the differential absorption of penetrating radiation by the structure being inspected. The position and shape of the defect on propellant and interfaces is derived based on the various radiographic techniques, which is very important. Third dimension and exact shape of the defects in bulk propellant is derived based on the triangulation method, which is used for large solid booster. Number of tangential and normal shots is finalized based on the geometrical contour and functionally critical region. Any separation between the insulation and propellant can be evaluated using tangential radiography technique. Single and double wall technique is adopted for clear visibility to interpret the defects of lower and higher diameter sizes of solid booster. Porosities are normally noticed in inhibition layers due to air entrapment during the mixing of resin. Densitometry study was carried out to decipher the compressed separation of insulation interfaces. From the basic density of the radiographic film the relative functional criticality is derive. Isolated and cluster of propellant voids, propellant crack, debond/separation between insulation and propellant interface are common defects seen in solid rocket motor. The functional severity of the defects was analyzed for each case for the acceptance of the article. Cluster and segregated propellant voids are evaluated from the radiographic testing and assessed its functional impact before clearing for further processing. This paper analyzes the radiographic evaluation of defects observed in various solid rocket motors in recent past and its detail assessment.