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Qualification des composants optiques laser pour les applications spatiales

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Foreword

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This document was prepared by Technical Committee ISO/TC 172, *Optics and photonics*, Subcommittee SC 9, *Electro-optical systems*.

Introduction

Laser technique is becoming increasingly important for space applications. Complex laser systems are used both for Earth observation and for planetary exploration. For long-term operations, optical components have to satisfy stringent requirements concerning precision and reliability. Before being used in space, all optical components have to be tested extensively. For standardized determination of laser damage threshold, ISO 21254 (all parts) should be applied. For characterization of optics for space applications, corresponding tests should be performed under vacuum conditions. In addition to laser damage issues, laser-induced molecular contamination (LIMC) should be taken into account. LIMC denotes the interaction of laser radiation, especially in case of high fluences and short wavelengths with volatile molecules and the resulting formation of deposits on optical components. LIMC proved to be particularly critical, if the laser system is operated under vacuum conditions and could considerably reduce the functionality of the whole laser system. Molecular contamination is mainly caused by organic materials and silicones, e.g. glues, adhesives, insulating material or circuit boards due to stronger outgassing rates compared to inorganic materials. The outgassing can be reduced but not totally prevented by selection of suitable materials and preconditioning, e.g. bake-out at elevated temperature well above the planned operating temperature. The outgassing behaviour of materials is generally characterized by these parameters: collected volatile condensable material (CVCM), total mass loss (TML), recovered mass loss (RML), volatile condensable material (VCM) and water vapour regained (WVR). Definitions and corresponding measuring specifications for these quantities can be found in ECSS-Standard Q-ST-70-02C, ASTM-E595-07 and ASTM-E1559.

This document outlines the test procedure for investigations of laser-induced molecular contamination in order to compare the growth of laser-induced depositions on optical surfaces for different molecular contamination materials.