

Single-crystal Intermediate Laser Coating (SILC)

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Laser ceramics with the capacity of large-size scaled fabrication is prospective for high-field lasers [1]. Over 100 kW from ceramics has been reported since 2009. However, the coating on laser ceramics confronts with serious Laser induced Damage (LiD) that hindered the development of high-energy ceramics laser. To further develop high-intensity laser, many efforts to improve laser induced damage threshold (LiDT) of coating have been reported. Traditional coating could be fabricated by the method of evaporation, ion beam sputtering (IBS) and advanced plasma reactive sputtering (APRS). It is of great motivation to bring up new solutions to enhance LiDT of coating on laser ceramics in high-intensity laser system. In this work, we propose a new coating solution for optical application named as Single-crystal Intermediate Laser Coating (SILC) by bonding single crystal and ceramics at room temperature through Surface Activated Bonding (SAB) technology with the purpose of enhancing the LiDT of coating on ceramics. Figure 1 shows the schematic SILC of sapphire single crystal on Nd³⁺:YAG polycrystalline ceramics and the LiDT fluence of the coating on Nd³⁺:YAG single crystal (141 J·cm⁻²) which is over one order higher than that on Nd³⁺:YAG polycrystalline ceramics (14 J·cm⁻²). It is approved that the average LiDT of SILC from sapphire single crystal is around 176 J·cm⁻², which is over 1 order higher compared with that from traditional film as directly coated on Nd³⁺:YAG polycrystalline ceramics. Meanwhile, large-sized scalable sapphire single crystal has the advantage of high thermal conductivity making the SILC a prospective solution for high-brightness and high-intensity laser operation [2].

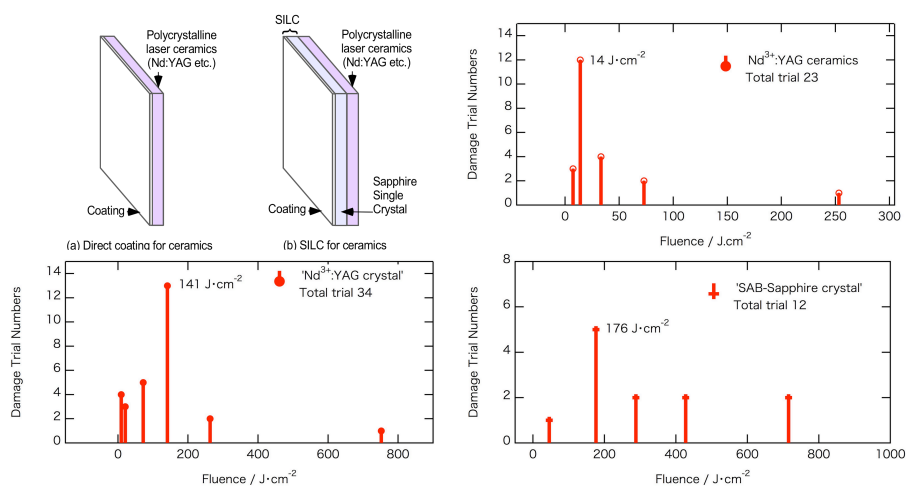


Fig. 1. Single-crystal Intermediate Laser Coating (SILC) and LiDT fluence of coating on ceramics and single crystal.

In summary, the LiDT fluence of coating on single crystal is approved with one order higher enhancement as compared with that on polycrystalline ceramics. The new coating solution named SILC is successfully realized to enhance the LiDT of coating on ceramics opening a brand new research field for high-field laser. The authors acknowledge supports from ImPACT and technical supports from Dr. M. Tsunekane and Dr. H. Ishizuki.

References

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