

5.3 Wavefront Reversing Mirrors for LIDAR Applications Using Optical Phase Conjugation

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Lidar instruments have been extensively investigated for many remote sensing techniques. For most applications they require powerful single frequency and frequency stable, long pulse lasers in the eye safe spectral range. With the development of diode pumped solid state lasers, a new generation of very promising lasers has appeared which brings the advantages of compactness, high efficiency and long lifetime, which is required for space borne instruments. However, the problem of achieving a high beam quality—also required by this application—still remains present although it is less severe than in flashlamp pumped solid state lasers. Beam aberrations can be eliminated or at least significantly reduced, if phase conjugate mirrors (PCM) based on stimulated Brillouin scattering are implemented in the laser design. We investigated the performance of different active materials that could potentially be used in PCM. We found that some liquids are very good candidates for such application provided they can be prepared enough pure. We observed, that high material purity is one of the most critical points for the reliable long term PCM operation. We have solved the problem of the material purification and optical cell cleaning by developing a special material preparation technique. Using this technique we were able to demonstrate very good PCM performance which was close to the calculated limit.