

## Technical Note – No. 6

### Definition of Output Power for Antireflection-Coated Diode Lasers

The output power of diode lasers strongly depend on the mirror reflectivity of the laser cavity where they are used in. This can be understood by a simple model description.

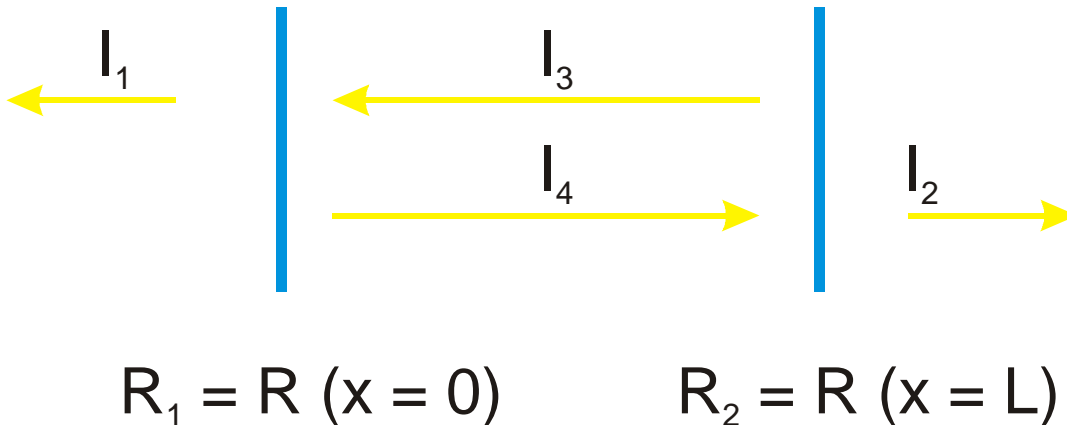


Figure 1: Schematic description of light propagation with a laser cavity

Beam  $I_3$  and  $I_4$  are propagating within the laser cavity which is defined by mirrors  $R_1$  and  $R_2$ . Beam  $I_1$  is the laser beam emitted by mirror  $R_1$ . Beam  $I_2$  is the laser beam emitted by mirror  $R_2$ . As one can read from Figure 1, the ration of the output power  $I_1/ I_2$  results to:

$$\frac{I_1}{I_2} = \frac{1 - R_1}{1 - R_2} \sqrt{\frac{R_2}{R_1}} \qquad (1)$$

Equation (1) describes the beam direction effect of AR-coatings on diode lasers. One clearly can see the strong effect of a small change of the facet reflectivity on the emission ratio  $I_1/ I_2$  between the optical power emitted from the front and the rear facet of the diode laser. This effect is described as Emission Direction Effect in literature, c/f <http://data.sacher-laser.com/publications/ao2003.pdf>.

This effect is still valid if a diode laser is coupled to an external cavity. Assuming the diode laser is coupled to an external cavity via beam  $I_2$ . In this case, the feedback of the external cavity can be described by a higher value of the mirror reflectivity  $R_2$ . The emission ratio  $I_1/ I_2$  of the diode laser is changed in a way that the output power  $I_2$  decreases and  $I_1$  increases. In summary, the power which is coupled out via the grating of a Littrow or a Littman cavity is inverse proportional to the reflectivity of the grating of the external cavity. Sacher Lasertechnik includes this effect into the definition of the output power of their diode lasers.

### Definition of Output Power for External Cavity Diode Laser Systems

Output powers given for antireflection coated diode lasers by Sacher Lasertechnik are always specified to be the output power which can be reached in a Sacher Lasertechnik laser system. Please be careful with output powers quoted by other suppliers who are not aware of this effect.

Document:: <http://data.sacher-laser.com/techdocs/power.pdf>

Sacher Lasertechnik GmbH  
Hannah Arendt Str. 3-7  
D-35037 Marburg, Germany

Tel.: +49 6421 305290  
Fax: +49 6421 305299  
Email: [contact@sacher.de](mailto:contact@sacher.de)

Sacher Lasertechnik, LLC  
5765 Equador Way  
Buena Park, CA 90620, USA

Tel.: 1-714-670-7605  
Fax: 1-714-670-7662  
Email: [sales@sacher-laser.com](mailto:sales@sacher-laser.com)



## Increasing Output Power of a Laser System by using AR Coated Diode Lasers

The described effect can be reversed by using high quality antireflection coated diode lasers. If a diode laser is provided with a Class d antireflection coated diode laser (c/f <http://data.sacher-laser.com/techdocs/classes.pdf>), then it is possible to use a low efficiency grating and to achieve a reflectivity of the external cavity which is comparable with the original reflectivity of the diode laser facet. Since Sacher Lasertechnik is the leading manufacturer of antireflection coated diode lasers (US Patent No. 6,297,066, Patent pending), we are able to provide external cavity diode laser systems with the highest output power on the market.

Document:: <http://data.sacher-laser.com/techdocs/power.pdf>

Sacher Lasertechnik GmbH  
Hannah Arendt Str. 3-7  
D-35037 Marburg, Germany

Tel.: +49 6421 305290  
Fax: +49 6421 305299  
Email: [contact@sacher.de](mailto:contact@sacher.de)

Sacher Lasertechnik, LLC  
5765 Equador Way  
Buena Park, CA 90620, USA

Tel.: 1-714-670-7605  
Fax: 1-714-670-7662  
Email: [sales@sacher-laser.com](mailto:sales@sacher-laser.com)

