near 980 nm. As shown in FIG. **12F2**, in the operational device, the extended cavity EWC **2403** is positioned adjacent the waveguide W **202** to form a superstrate thereon. The cavity EWC **2403** includes a cladding layer CL interposed between the cavity and the waveguide W **202** that prevents pump light from uniformly leaking out of the cavity EWC **2403** and into the waveguide W **202**. Instead, apertures AP are located in the layer CL that selectively leak pump light from the cavity EWC **2403** to the waveguide W **202**. The apertures are placed so as not to interfere with the grating G **230** of the substrate wave guide **202**. As pump light **2401** resonates within the extended diode laser cavity EWC **2403**, a portion of the light is transmitted to the substrate waveguide W **202** along a portion of its length to cause lasing action therein. The diode pump laser **2401** cavity EWC **2403** in some embodiments has a lower index of refraction than the substrate waveguide and constitutes part of the cladding thereof. Pump light **2401** is thus transmitted to the substrate waveguide W **202**, but laser light from the laser species within the substrate waveguide **202** is contained by the total internal reflection of the propagating mode due to the relatively higher refractive index of the substrate waveguide with respect to the substrate and diode pump laser cavity EWC **2403**. In this embodiment, the substrate waveguide **202** and diode laser cavity **2403** are separated by a layer of interposed cladding having apertures AP defined therein for transmitting the pump light into the substrate waveguide **202** at selected locations. In another embodiment, the substrate waveguide **202** and diode laser cavity are separated by a gap at aperture AP with transmission of pump light into the substrate waveguide **202** occurring via evanescent coupling. In still other embodiments, the cladding layer CL may be fabricated as a resonant ARROW structure to produce the same effect. In one embodiment, end facet EF**2** is highly reflective at pump wavelength 980 nm; end facet EF**3** is highly reflective at output wavelength 1536 nm; end facet EF**1** is anti-reflective at pump wavelength 980 nm; end facet EF**4** is anti-reflective at output wavelength 1536 nm.

In the embodiment shown in FIGS. **2**A and **2**B, reflective element EF**3**, (which may be mirrors or distributed Bragg reflection gratings) and grating G **230** are located along the substrate waveguide **202** for providing feedback in order to form a laser-resonator cavity within the waveguide W **202**, with the grating G **230** made partially reflective for providing laser output. Other embodiments may omit the feedback elements EF**3** and G to form a laser amplifier. Other possible modifications of this aspect of the invention include the use of a bulk optic component to couple light from the diode pump laser gain section to the extended cavity EWC, and the incorporation of grating stabilization of the diode pump laser via a distributed-feedback grating formed in the extended cavity EWC. Other embodiments include fabricating an amplifier section in place of the laser cavity **202**.

The embodiment of the invention described with reference to FIGS. **2**A and **2**B thus presents an improvement over prior methods of cladding pumping of waveguide lasers and amplifiers. By using the diode pump laser cavity **2403** as a secondary cladding for the substrate waveguide W **202**, as opposed to simply coupling the output of the diode pump laser **2401** to the secondary cladding, cladding pumping of very short (i.e., 1 cm or less) substrate waveguide lasers is thereby made possible. The configuration also permits mass production of a number of separate devices fabricated from a single superstrate formed on a single substrate having an array of waveguides defined therein.

FIG. **3** shows an isometric view of an optical chip **200** having a laser **202** comprising waveguide **220**, DBR mirror **230** and optional input mirror **240** according to one embodiment of the present invention. FIG. **6** shows more detail of a single laser **202** having an external launch mirror **240**, which is transmissive at the pump light wavelength but highly reflective at the lasing wavelength of laser **202**, and is used to launch the pump light into the laser cavity. Other embodiments include redundant waveguides all operating at a single wavelength, other waveguides **220** each having a DBR **230** tuned to a unique wavelength, or combinations thereof, all integrated on a single optical chip **200**. In various embodiments, optical chip **200** of FIG. **6** is made with one of the configurations of FIGS. **2**A–**2**B described above. In some embodiments, a plurality of operable lasers **202** are provided on each chip **200**.

FIG. **4** shows a top view of a laser **900** using direct (butt) coupling of pump laser diode **310** to optical chip **200** according to one embodiment of the present invention.

FIG. **5** shows a top view of a laser **1000** using lensed coupling of pump laser diode **310** to optical chip **200** according to one embodiment of the present invention.

FIG. **6** shows a top view of a laser **1100** using a fiber coupling of pump laser diode **310** to optical chip **200** according to one embodiment of the present invention.

It is understood that the above description is intended to be illustrative, and not restrictive. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description. The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled.

What is claimed is:

**1**. An optical component comprising:

a glass substrate doped with a laser species;

a substrate waveguide defined within the glass substrate, the substrate waveguide having an output facet; and

a diode pump laser having a diode laser and a waveguide cavity abutted to an output facet of the diode laser to provide an extended waveguide cavity such that a laser resonator cavity of the diode pump laser includes the extended waveguide cavity, the extended waveguide cavity being positioned adjacent, above and along to a length of the substrate waveguide, the extended waveguide cavity coupled to the substrate waveguide so that pump light from along a length of the extended waveguide cavity of the diode laser's resonator cavity is transferred into the substrate waveguide along at least a portion of the length of the substrate waveguide to provide light from the output facet of the substrate waveguide.

**2**. The optical component of claim **1** wherein the substrate is doped with Yb and Er.

**3**. The optical component of claim **1** wherein the substrate is doped with Er.

**4**. The optical component of claim **1** wherein the substrate waveguide forms a laser resonator cavity within the substrate.

**5**. The optical component of claim **4** further comprising a reflection grating formed on the substrate surface along the substrate waveguide that provides feedback to the substrate waveguide's laser resonator cavity.

**6**. The optical component of claim **5** further comprising:

a cladding deposited on the reflection grating of the substrate waveguide, the cladding being composed of an electro-optic polymer with a variable index of refraction; and