Nanoimprinted DWDM laser arrays on indium phosphide substrates

Dense wavelength division multiplexing lasers play a major role in today's long-haul broadband communication. Typical distributed feedback laser cavities consist of long half-pitch gratings in InGaAsP on InP substrates with grating periods of around 240 nm. The lasers include a quarter wavelength shift in the grating, and are single mode with high side-mode suppression. Typically, such lasers are patterned using e-beam lithography (EBL). We present a fabrication method based on patterning by thermal nanoimprint lithography, which is potentially less costly and faster than EBL. Thermal nanoimprint lithography of laser gratings raises two types of challenges: (1) The imprint process itself is delicate due to the mechanical fragility of indium phosphide substrates and the thermal mismatch between the substrate and the silicon stamp. (2) The subsequent processing puts requirements on the imprint resist thickness after patterning, and the alignment between the crystallographic direction of the substrate and the grating pattern. Working laser arrays were produced, with >40 mW optical power and side mode suppression ratios of more than 50 dB in all 12 channels.