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Introduction

Silicon carbide (SiC) is a semiconductor which has attracted interest in research and industry since the 19:th century, when it was first fabricated and used as an abrasive [1]. Silicon carbide has been found to be a very stable material. It exhibits a high chemical inertness [2], and is currently commonly used in high power, temperature and radiation applications due to its ability to survive in such environments [3].

Silicon carbide is a material which exists in a large number of different polytypes, the most common of which are the hexagonal, cubic and rhombohedral polytypes. The work described in this thesis deals with the cubic polytype, denoted *3C-SiC*. This is one of the structurally most simple polytypes, and the only cubic one. Compared to the hexagonal counterparts 4H- and 6H-SiC, the 3C-SiC polytype has for a long time been difficult to fabricate in good quality and large volume. It is therefore less studied than the hexagonal types. Recently a method of fabricating good quality free standing cubic material using sublimation growth has been reported [4]. This method has been used to grow the samples used in the work described in this thesis. With this method it is possible to grow free-standing 3C-SiC, which means that the material is thick enough to exist on its own after mechanically polishing away the 4H-SiC substrate.

Cubic SiC has many interesting material properties. It has a higher electron mobility compared to the common hexagonal polytypes [5]. It has also attracted attention as a transistor material, since it can can achieve a low number of interface defects in such structures [6]. One proposed application for which 3C-SiC is well suited is the use of boron doped 3C-SiC in an intermediate band photovoltaic solar cell. This is suitable for 3C-SiC due to its band gap size of 2.36 eV, together with the binding energy of boron as an acceptor in the material, which is almost ideal for photovoltaic cell material. This would give a significant increase in photovoltaic cell efficiency compared to the conventional single junction alternative [7, 8]. Another proposed application of 3C-SiC is as a photo-electrode in a photoelectrochemical cell used for water splitting [9, 10], where solar energy is used in the decomposition of