FRACTURE SURFACE INVESTIGATION OF STAINLESS STEEL REBARS

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Abstract

The use of stainless steel reinforcing bars has recently attracted much attention in the civil engineering community due to its superior material properties, including high corrosion resistance and high specific strength. However, as with all new materials, a number of shortcomings are unavoidable, such as high initial costs, unknown low-cycle fatigue behaviour, uncertain ductility properties and unidentified bond-slip behaviour between the embedded bar and grouted duct in precast concrete element. In recent years there has been an increasing interest in applying stainless steel reinforcement in concrete structures to combat the durability problems associated with chloride ingress. However, the use of stainless steel reinforcement has so far been limited mainly due to high costs and lack of design guides and standards. The study of fractures has been approached in several ways. One procedure is to categorize fractures on the basis of macro- or microscopic features, that is, by macro- or microfractography. The fracture path may be classified as transgranular or intergranular. Another approach is to classify all fractures as either ductile or brittle, with all others, such as fatigue, being special cases of one or the other. In general, all fractures can be grouped into four categories: ductile, brittle, fatigue, or creep. Using a scanning electronic microscope it was possible to observe and evaluate the cavities which are situated on the fracture surface. The materials we selected for this purpose included Enduramet 32 rebar, 316LN rebar, and 2205 Duplex and MMFX II. Coarse areas at the top demonstrate that those were the places where the specimens finally fractured. A certain amount of fracture sections of the low-cycle fatigue test specimens were almost perpendicular to the longitudinal direction of the specimens, while the others were slanted, which shows that the shear lips do affect the growth of the crack.

Keywords*:* *stainless steels, reinforcing, concrete structures, fracture, rebar.*