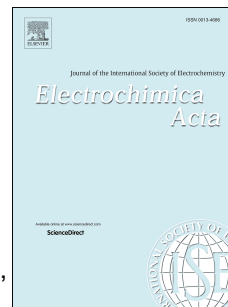


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Orientation of a *Trametes versicolor* laccase on amorphous carbon nitride coated graphite electrodes for improved electroreduction of dioxygen to water

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Abstract

Amorphous carbon nitride (a-CN_x) thin films were used for the first time as electrode materials in the elaboration of biofuel cell cathodes as a consequence of i) the natural presence of amine type functional groups and ii) the ease to generate carboxylic acid groups on their surface with the help of an anodic treatment. Their rich surface chemistry was exploited to investigate the influence of the orientation of immobilised laccase on their bioelectrocatalytic activity towards oxygen reduction reaction (ORR) in a direct electron transfer configuration. Among four different immobilisation strategies leading to a statistical control of the orientation and tested in this work, spontaneous adsorption of natural laccase on pristine a-CN_x provided the smallest current density value (3.5 $\mu\text{A}\cdot\text{cm}^{-2}$) whereas covalent grafting of oxidised laccase on anodically treated a-CN_x via imine and amide bond formation using a coupling agent led to a much higher but still low 44.6 $\mu\text{A}\cdot\text{cm}^{-2}$ current density. This substantial improvement of the current density value measured for ORR confirms that the orientation of immobilised laccase exerts a measurable influence on its bioelectrocatalytic activity towards ORR.

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