# Electrochemical Application of Boron-doped Diamond Electrodes

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Boron-doped diamond (BDD) electrodes are very attractive material, because of their wide potential window, low background current, chemical inertness, and mechanical durability.[1] In these years, we have reported several electrochemical applications such as electrochemical organic synthesis,[2] $CO_2$ reduction,[3] and electrochemical sensor. Here, several examples for those application are introduced.[4]

Microsensing system for in vivo real time detection of local drug kinetics[4a]

We have developed a microsensing system for in vivo real time detection of local drug kinetics and its physiological relevance. The system consists of two different sensors of both BDD microelectrodes with tip diameter ~40 μm and a glass microelectrode. By using the system, we have first tested bumetanide, a diuretic that is ototoxic but applicable to epilepsy treatment.

Real-time Measurement of Antiglaucoma Drugs [4e, 4f]

The primary treatment for glaucoma, the most common cause of intermediate vision impairment, involves administering ocular hypotensive drugs in the form of topical eye drops. Observing real-time changes in the drugs that pass through the cornea and reach the anterior chamber of the eye is crucial for improving and developing safe, reliable, and effective medical treatments. We have developed a measurement method that employs BDD microelectrodes to monitor real-time drug concentrations in the anterior chamber of the eye. We optimized the method for continuous measurement of drugs, and generated calibration curves for each BDD microelectrode using aqueous humor. We successfully demonstrated the continuous monitoring of drug concentrations in the anterior chambers. Furthermore, recently, the pharmacological effect of brimonidine tartrate (BRM), i.e., a reduced intraocular pressure, was observed 30 min after administration, lagging behind drug migration. These findings may provide valuable insights into the ocular pharmacokinetics of novel drugs and facilitate the development of more effective therapeutic approaches.

Molecularly Imprinted Polymer-Modified BDD Electrodes[4g]

We developed an electrochemical sensor using a BDD electrode modified with a molecularly imprinted polymer (MIP) to provide specificity in drug sensing. By the strategy, selective DOX measurement using the MIP–BDD was also possible in human plasma. The MIP–BDD was durable for use in several repeated measurements, and it may be applicable as an electrochemical sensor for application in therapeutic drug monitoring.

**References**

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