Lignin is a large and complex macromolecule which is a substantial but mostly unused building block of wooden plant matter. Currently it is a waste product of several industries although it is a promising feedstock for aromatic base chemicals. Electrochemical valorization of lignin contributes to closing the carbon cycle while making direct use of renewable energies without being hampered by their weather dependencies. Lignin is made up of three types of aromatic monomers with characteristic linkages. These will have to be cleaved to gain access to the aromatic building blocks. A common approach is to target the most common ether-bridge -O-4. This work aims to understand the cleaving process of -O-4 via electrochemical oxidation with an in-house designed *in situ* ATR-IR spectroscopic cell. This dedicated cell design allows for the division of the cathode and anode compartment ensuring that all intermediates observed are only products of the targeted electrooxidation. The cell can be switched between two modes of operation: Either the electrode is held above the ATR crystal so that the electrolyte is probed, or the electrode is sputtered directly onto the ATR crystal to probe the electrode surface.