Held every second year and at Wageningen University in 2016, Oxizymes is a conference focusing on oxidoreductases and reporting on their discovery, their characteristics, their applications while gathering experts from academia and industry. In the Sophie Vanhulle lecture, I presented examples of how microbial oxidative enzymes can be used to functionalize material surfaces either as catalysts for protein immobilization or as functional molecules to be immobilized. Proteins and materials are indeed combined in a variety of devices of everyday use that find application in the energy, biomedical, and diagnostics fields. To preserve the bioactivity of proteins while minimizing the deleterious effects caused by the interaction with the material surface, the controlled and site-specific immobilization of proteins is desired. We explored enzymatic and affinity-based approaches using fluorescent proteins, enzymes, and peptides. The specificity offered by the fungal enzyme tyrosinase has been applied to the immobilization of fluorescent proteins in a site-specific manner. These were genetically engineered to carry one exposed tyrosine residue that, specifically recognized by tyrosinase, could be oxidized and further react with functional groups on the material surfaces that thus acquired an intense fluorescence. By genetic engineering, proteins can also be modified to carry affinity motives for specific materials. We recently engineered a fluorescent protein and a bacterial laccase from *Bacillus pumilus* with an affinity peptide for iron oxide. This promoted the binding of the fluorescent protein to the material surface and, in the case of the enzyme, led also to an enhancement in catalytic activity. To develop highly functional surfaces in which all components are present under their optimal working conditions, the development of novel approaches aiming to control the interaction of proteins with materials is crucial and a rich topic of study.