

# 细胞黏附压电传感响应机制分析

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基于压电传感器的一维多层及传输线等效电路模型, 利用声阻抗概念, 将传感器响应与声阻抗直接联系, 建立起压电传感器响应机制的声阻抗模型。由此模型对单、双层等基本负载分别导出相应的传感器响应方程。理论分析表明, 声阻抗是生物传感的核心, 可通过其阐明各种传感器响应机制的物理意义, 特别是细胞黏附的压电传感响应机制分析。实验结果良好地验证了细胞黏附行为的压电传感响应声阻抗理论, 据此建立了频率变化 $\Delta f$  (Hz) 与细胞浓度 $C$  ( $\text{ml}^{-1}$ ) 之间良好的线性关系, 相关系数 $R=0.98$ , 其线性方程为 $\Delta f=-246C-20.1$  ( $P<0.001$ )。研究对细胞黏附的压电传感及其应用具有指导意义。

## Analysis of the response mechanism of cell adhesion on piezoelectric sensor

Based on the transmission line model of piezoelectric sensor, acoustic impedance theory has been advanced to explain the response mechanism of piezoelectric sensor. By this theory some basic response equations for various loading on piezoelectric sensor were produced, specially for the cells adhesion. In addition the experiments were done to testify the theoretical model on sensor response to cell adhesive behaviors. The results showed there was a linear relationship between the frequency shift,  $\Delta f$  (Hz), and the concentration of cells,  $C$  ( $\text{ml}^{-1}$ ), in which the coefficient was 0.98 and the equation was  $\Delta f=-246C-20.1$  ( $P<0.001$ ).

### 关键词

声阻抗(Acoustic impedance); 压电生物传感器(Piezo-electric biosensor); 细胞黏附(cells adhesion)