Aspects Regarding Electrochemical Actuation

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Electrochemical microactuators that work by using the development of gas in a miniature electrolysis cell to create pressure or generate mechanical work were studied in this paper. A number of possible models with promising applications were examined by determining their consumption parameters (electrical tension, current intensity) and parameters of function (pressure, debit for liquid dosing). A cylindrical model of an electrolysis chamber was studied mathematically. The volume of gas released and the number of moles of gases formed as functions of time were shown to be exponential decays with small coefficients for time. An actuator where the flow of gas held a hollow spherical object in a vertical position, allowing usage as an accelerometer, was theoretically examined and it was found that a potentiometer would be needed for optimal function. An actuator with two chambers: one for electrolysis and one for a liquid that would be distributed, was designed and manufactured from plexiglass, for uses in drug distribution. Actuation using porous materials soaked in electrolyte was investigated. The gas produced in the electrolysis of the solution deformed the sponge and this displacement varied quadratically with time. The force generated was large compared to other types of actuators at the same scale, allowing for applications such as microvalves. This study showed that microactuators based on electrolysis may serve in many areas, being able to function as pistons, active valves or constant pressure making devices. The practical models examined are efficient in terms of energy consumption and actuation, showing great potential.