Abstract Submitted
for the GEC09 Meeting of
The American Physical Society

Determination of gas phase and surface reactions in plasma polymerization DIRK HEGEMANN, Empa, St.Gallen/Switzerland — Using macroscopic kinetics, the reactions within the gas phase are governed by the reaction parameter power input per gas flow W/F, which corresponds to a specific energy, while reactions by energetic particle bombardment at the growing film surface are rather related to power input W alone. Assuming activation reactions, the mass deposition rate per gas flow can be described by an Arrhenius-like approach:

$$\frac{R_m}{F} = G \exp\left(-\frac{E_a}{W/F}\right)$$

Mixtures of hydrocarbons (C_2H_4) and reactive gases (CO_2, N_2+H_2) were examined within low pressure RF plasmas. Thus, functional a-C:H:O or a-C:H:N plasma coatings result. At increasing energy input it is found that the deposited mass shows a deviation from the above equation, commonly related to energetic particle interactions. However, using the same range of W/F with varying power input W, it was found that the observed drop in deposition rate scales solely with energy input W/F for a-C:H:O, i.e. depending on plasma chemistry. a-C:H:N films, on the other hand, show both chemical and physical influences on the film growth. Hence, gas phase reactions such as a change of film-forming species play a major role in plasma polymerization.

Dirk Hegemann
Empa, St.Gallen/Switzerland

Date submitted: 03 Jun 2009 Electronic form version 1.4