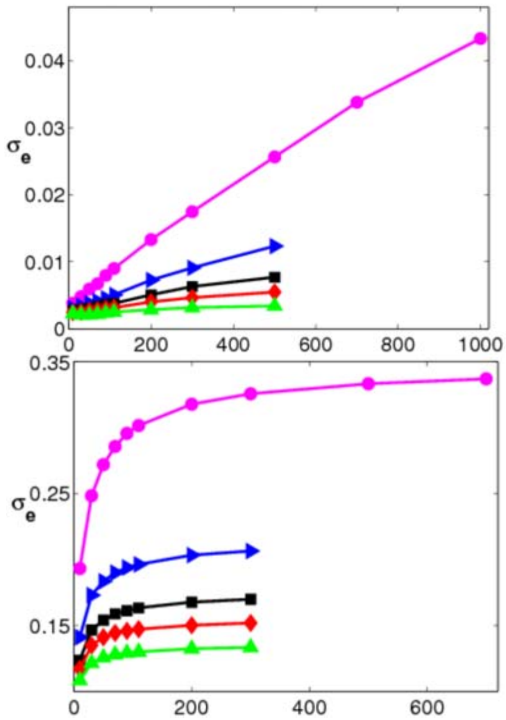

Fig. 2. The effective conductivity σ_e as a function of time t for L=512a and frequencies, s=0(Top figure), 0.01(bottom figure). The results are for the particles sizes 2a, 4a, 6a, 8a, and 12a (from top to below).

As the clusters have the random shapes and sizes, the growing surfaces are porous [9]. Fig.3, shows a part of rough porous thin films which are produced by random shaped clusters.

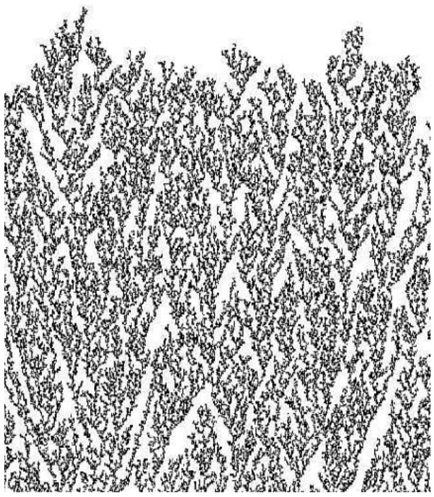

Fig. 3. A piece of porous films that are grown by deposition of random shapes and sizes clusters.

The results of Fig. 2 shows that the σ_0 depends on stationary porosity value. So this dependency presents in Fig. 4. This dependency is linear and for the range of cluster's size which the cluster size increase with increasing the porosity, the data approximated by the following equation:

$$\sigma_0 \approx -0.23\varphi_s + 0.17 \quad , \quad (16)$$

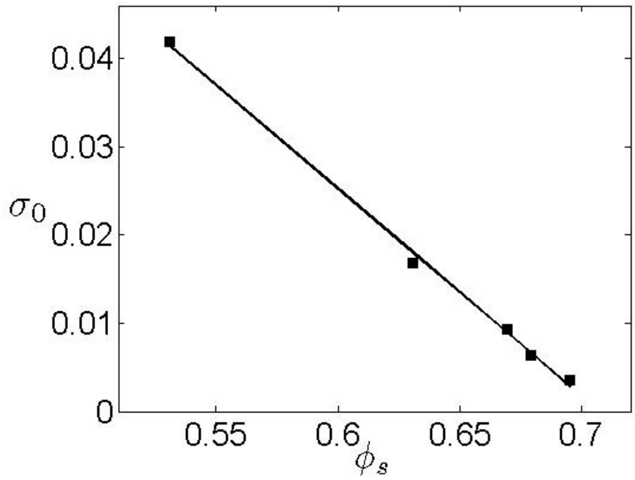

Fig. 4. The dependence of the dc conductivity σ_0 on the saturated porosity ϕ_s.

IV. Conclusion

In this paper, we studied the frequency-dependent effective conductivity of porous thin films which these films are grown by different shapes and sizes clusters and its dependence to several properties. Our findings showed that the effective conductivity is related to the film's morphology. The frequency-dependent effective conductivity σ_e, is a decreasing function of the deposited cluster's sizes, as well as the porosity. Therefore, the σ_e, decreases with increasing the clusters sizes. The dc conductivity σ_0, as a function of cluster'size and the stationary porosity presents a power law and a linear dependency, respectively.

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