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A tribute to Marian Smoluchowski's legacy on colloid type matter aggregation, and related issues

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In 1916 Marian Smoluchowski proposed a case of constant-kernel cluster cluster aggregation, for which it is manageable to find analitycally by employing scaling arguments, a solution in terms of the cluster size (k) distribution function, n(k) [1,2].
By applying this scaling function it is then possible to get, within the long times' limit, the results for the mean cluster size {k} and the total number of the clusters N, both scalable in terms of time t with a single exponent, g [2].
The clustering arguments, first introduced by Smoluchowski [1], are easily applicable to statistical description of physical-metallurgical processes and ceramic-polycrystalline evolutions, termed the normal grain growth, in which bigger clusters grow at the expense of their smaller neighboring counterparts due to capillary conditions [3].
The normal grain growth, and its dynamics, can be expressed in d-dimensional space (d - Euclidean dimension of the space). Upon identifying {k} from the Smoluchowski description with {R}, the mean cluster radius' size from the normal grain growth approach, and by taking the "extreme" condition of k » 0, one is able to embark on their equivalence by stating rigorously that g=1/(d+1), since the asymptotic scaling rule for N (here: the number of grains) goes via a simple logarithmic depiction as: ln[N]~-ln[g].
The crucial assumption, however, that assures the equivalence claimed, appears to be fully feasible when rearranging the time domain by substituting t in a way such that a new rescaled time variable T(t) is given by a definite integral in [0,t] upon dT(t)=dt/f(t), with an adjustable function f, coming from the dispersive or long-tail, or fractal kinetics' arguments [4].
The arguments may at least qualitatively concern biomembranes dynamics; they can also contribute to nucleation-growth processes in (psychodynamic-clustering) living matter conditions [5-7].

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