ELSEVIER

Physics Reports 258 (1995) 377-411

PHYSICS REPORTS

Statistics of self-avoiding walks on random lattices

K. Barat [1], Bikas K. Chakrabarti [2]

Saha Institute of Nuclear Physics, 1/AF Bidhan Nagar, Calcutta 700064, India

Received January 1995; editor: I. Procaccia

Contents:

Abstract

Self-avoiding-walk (SAW) statistics on randomly dilute lattices is reviewed. The phase diagrams, giving the variations of the SAW connectivity constant and of the tricritical or θ-point, with lattice dilution, are obtained by employing various numerical methods. The numerical estimates are compared with those obtained using various analytical and mean field-like estimates of the phase diagram. The critical behaviour, given especially by the SAW size exponents in the high temperature limit and at the θ-point, are studied on dilute lattices. Specifically, the size exponents on the percolating fractals are investigated and discussed. Fractal effects on the statistics of SAWs are identified, and the numerical values obtained for the size exponents are compared with various analytic (renormalisation group etc.) and Flory-like (mean field) estimates.

[1] Permanent address: Physics Department, Vidyasagar College for Women, 39 Sankar Ghosh Lane, Calcutta 700006, India.
[2] E-mail: bikas@saha.ernet.in.

SSDI 0370-1573(95)00009-7

[12] K. Kremer, Z. Phys B. 45 (1981) 149.
[13] Y. Meir and A.B. Harris, Phys Rev Lett 63 (1989) 2819.
[14] A.K. Roy, B.K. Chakrabarti and A. Blumen, J. Stat Phys 61 (1990) 903.
[15] K. Barat, S.N. Karmakar and B.K. Chakrabarti, J. Phys I. (France) 3 (1993) 2007; J. Phys A. 25 (1992) 2745
[16] B.K. Chakrabarti and S.S. Manna, J. Phys A. 16 (1983) L113;
S.S. Manna and B. K. Chakrabarti, J. Phys A. 17 (1984) 3237;
J.L. Cardy, J. Phys A. 16 (1983) L355;
S. Redner and I. Majid, J. Phys A. 16 (1983) L307;
A.J. Guttmann, T. Prellberg and A.L. Owczarek, J. Phys A. 26 (1993) 6615.
[17] J.P. Nadal and J. Vannimenus, J. Phys (France) 46 (1988) 17;
M Kardar and Y.C. Zhang, Phys Rev Lett 58 (1987) 2087;
M. Kardar, G. Parisi and Y.C. Zhang, Phys Rev Lett 56 (1986) 889;
S.P. Obukhov, Phys Rev A. 42 (1990) 2015;
Le Dousal and J. Machta, J. Stat Phys 64 (1991) 541.
[18] C. Vanderzande and A. Komoda, Europhysics Lett 14 (1991) 677, Phys Rev A. 45 (1992) 5335;
I. Smailer, J. Machta and S. Redner, Phys Rev E. 47 (1993) 262;
J.D. Honeycutt and D. Thirumalai, J. Chem Phys 90 (1989) 4542, 93, (1990) 6851;
P. Grassberger, J. Phys A. 26 (1993) 1023;
see also, B. Derrida, J. Phys A. 15 (1982) L119; Phys Reports 103 (1984) 29.
[19] M.D. Rintoul, J. Moon and H. Nakanishi, Phys Rev E. 49 (1994) 2790.
[20] J.L. Martin, in Phase Transition and critical Phenomenon, vol.3, Eds. C. Domb and M.S. Green, Academic Press, NY (1974) p. 97 .
[21] A.K. Roy and B. K. Chakrabarti, J. Phys A. 20 (1987) 215;
Y. Kim., Phys Rev A. 41 (1990) 4554;
Y. Kim, J. Phys A. 20 (1987) 1293; Phys Rev A. 45 (1992) 6103;
K.Y. Woo and S.B. Lee, Phys Rev A. 44 (1991) 999.
[22] K. Barat K, S.N. Karmakar and B.K. Chakrabarti, J. Phys A. 24 (1991) 851.
[23] P.M. Lam, J. Phys A. 23 (1990) L831;
H Nakanishi and S.B. Lee, J. Phys A. 24 (1991) 1355;
H. Nakanishi and J. Moon, Physica A. 191 (1992) 309.
[24] A.K. Roy and B.K. Chakrabarti, Phys Lett 91A (1982) 393;
P M. Lam and Z.Q. Zhang, Z. Phys B. 56 (1984) 155;
M. Sahimi, J. Phys A. 17 (1984) L379;
D. Markovic, S. Milosevic and H.E. Stanley, Physica A. 144 (1987) 1.
[25] B.K. Chakrabarti and S.M. Bhattacharjee, J. Stat Phys 58 (1990) 383;
K Barat, Die Makromolekulare chemie: Theory and Simulations 2 (1993) 637;
K Barat and S.N. Karmakar (1994) unpublished.
[26] Y. Kim, J. Phys C. 16 (1983) 1345.
[27] S.B. Lee and H. Nakanishi, Phys Rev Lett 61 (1988) 2022;
S.B. Lee, H. Nakanishi and Y. Kim, Phys Rev B. 39 (1989) 9561.
[28] D. Dhar, J. Math. Phys 18 (1977) 577; in Polymer Physics: 25 Years of the Edward's model, S.M. Bhattacherjee Ed; World Scientific, Singapore, (1992) p. 83;
R Rammal, G. Toulouse and J. Vannimenus, J. Physique 45 (1984) 389;
I Zivic, S. Milosevic and H.E. Stanley, Phys Rev E. 47 (1993) 2430;
S Milosevic and I. Zivic, J. Phys A. 26 (1993) 7263.
[29] K. Wu and R.M. Bradley, Phys Rev A. 41 (1990) 6845.
[30] I.S. Chang and A. Aharony, J. Phys I. (France) 1 (1991) 313.
[31] H.J. Herrmann and H.E. Stanley, J. Phys A. 21 (1988) L829.
[32] C. Liem and N. Jan, J. Phys A. 21 (1988) L243.
[33] S. Havlin and D. Ben Avraham, Adv Phys 36 (1987) 695.