



1. H.K. Henisch: Periodic precipitation. Pergamon Press, Oxford 1991.
2. R.E. Liesegang. Naturwiss. Wochschr. 11, 30(1896)353-362.
3. Hatschek, E.: Kolloid Z. 14(1994)115.
4. I. Das, R.S. Lall, A. Puskkarna: Mechanism of periodic precipitation in an illuminated lead chromate system. J. Phys. Chem 91(1987)747-750.
5. I. Das, A. Pushkarna: Light induced periodic precipitation and chemical instability in lead chromate systems. J. Non-Equilib. Thermodyn. 13(1988) 209-220.
6. I. Das, S.S. Das, A. Pushkarna, S. Chand: Chemical instability and periodic precipitation of copper chromate in gel media. J. Colloid and Interface Sci. 130(1989)176-182.
7. I. Das, S. Chand, A. Pushkarn. Chemical instability and periodic precipitation of CuCrO_4 in continuous-flow reactors: Crystal growth in gel and PVA polymerfilms. J. Phys. Chem. 93(1989)7435-7440.
8. I. Das, A. Pushkarna, S. Chand.: Electrical field effect on periodic precipitation and chemical waves in gel media in batch and continuous-flow reactors. J. Colloid and Interface Sci. 150(1992)178-185.

9. D. Lexa, V. Holba: Periodic precipitation of silver chromate/dichromate in gelatin.
Colloid Polym. Sci. 271(1993)884-890.
10. Gerrard, J.E., Hoch, M., and Meeks, F.R.(1962) Acta Metallurgica 10,751.
11. Amandus H. Shorbaugh: An experimental Study of the Liesegang phenomenon and crystal growth in silica gels. J. Chem. Edu. 66,7(1989)589-594.
12. J.H. Adair, S.A. Touse, P.J. Melling: Chemically derived multilayer ceramics.
Am. Ceram. Soc. Bull. 66,10(1987)1490-1494.
13. R. Matalon, A. Packter: The Liesegang phenomenon. I. Sol protection and diffusion. J. Colloid Sci. 10(1955)46-62.
14. M. Kahlweit: On the kinetics of phase formation in condensed systems. V. Periodic precipitation and a model experiment on Z. Phys.Chem. (N.F.) 32(1962)1-26.
15. H.W. Morse, G.W. Pierce: Diffusion and super-saturation in gels. Z. Phys. Chem. 45(1983)589-607.
16. H.K. Henisch, J.M. Gracia-Ruiz:Crystal growth in gels and Liesegang ring formation. I. Diffusion relation-ships. J. Cryst. Growth 75(1986) 195-202.

17. H.K. Henisch, J.M. Gracia-Ruiz: Crystal growth in gels and Liesegang ring formation. II. Crystallization criteria and successive precipitation. *J. Cryst. Growth* 75(1986)203-211.
18. H.K. Henisch: Liesegang ring formation in gels. *J. Cryst. Growth* 76(1986)279-289.
19. H.K. Henisch: Periodic precipitation. Pergamon Press, Oxford 1991.
20. A.G. Walton: The formation and properties of precipitates. Robert E. Krieger Publ. Co., New York 1979.
21. H.K. Henisch: Crystal growth in gels. Chapter 1. Pennsylvania State University Press, University Park 1970.
22. K.F. Mueller: Periodic interfacial precipitation in polymer films. *Science* 225,9(1984)1021-1027.
23. S. Jin, T.H. Tiefel, R. Wolfe, R.C. Sherwood, J.J. Mottine Jr.: Optically transparent, electronically conductive composite medium. *Science* 255(1992) 445-448.
24. G. Varghese, M.A. Ittyachen. *J. Mat. Sci. Let.* 11 (1992)916-917.

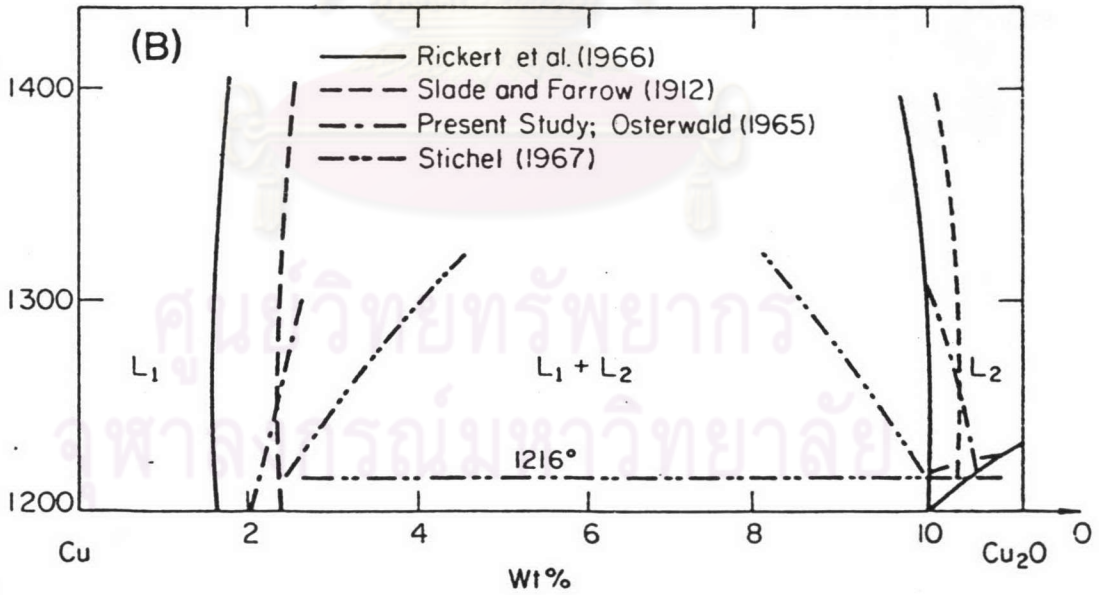
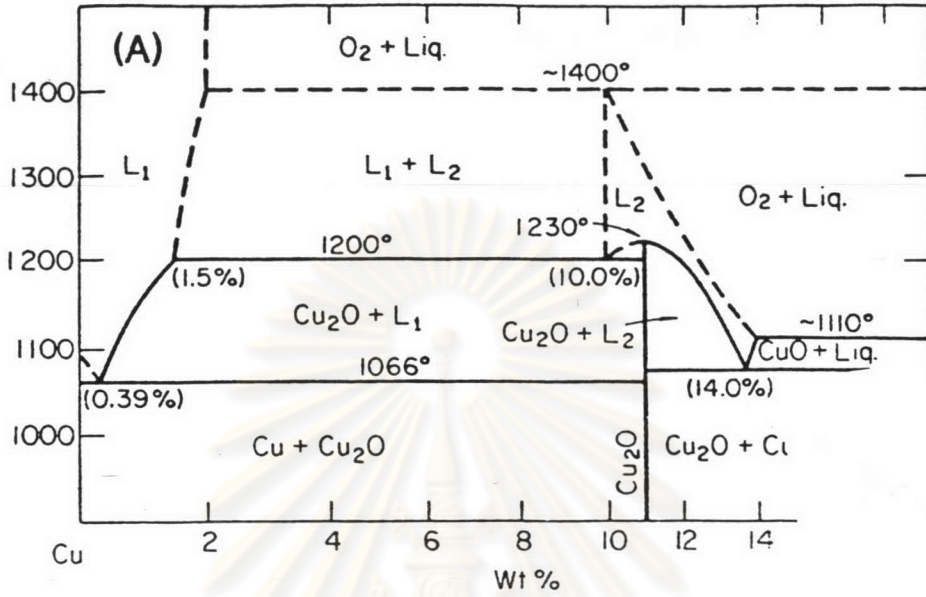
25. G. Varghese, M.A. Ittyachen, C. Joseph: Estimation of diffusion coefficients and a plausible identification of species from one-dimensional Liesegang-ring formations in multicomponent systems. *J. Mat. Sci.* (1993)6357-6359.
26. R.M. Dharmaprakash, P. Mohan Rao: Diffusion coefficient of J. Mat. Sci. Let. 8(1989)141-143.
27. Y. Brechet, J.S. Kirkaldy: Contribution to the theory of diffusion-reaction controlled Liesegang patterns. *J. Chem. Phys.* 90,3(1989)1499-1504.
28. P. Pimkhaokham, R. Conradt, U. Leela-Adisorn: Silica aqua-gels with periodically precipitated inorganic compounds as precursors of new composite materials. Research report. The Toray Science International Research Grant,1993.
29. C. Lordchavanakult.: Analytical chemistry I.Chapter 5. Ramkhomhang University. 1989.
30. G. Venzl:Pattern formation in precipitation processes. II. A postnucleation theory of Liesegang bands. *J. Chem. Phys.* 85,4(1986)2006-2011.
31. W. Jost: Diffusion in solids, liquids, gases.Academic Press, New York. 1960.
32. J. Crank: The mathematics of diffusion. Oxford University Press, London. 1956.

33. M. Volmer, *Kinetic der Phasenbildung*, Steinkopff, Dresden, 1939.
34. P. Pimkhaokham, R. Conradt, S. Saejiang: Combination of the colloidal sol-gel, periodic precipitation, and viscous sintering techniques in developing new glass composite materials. Research report. The Ratchada Phisek Research Grant, 1994.
35. M. Nogami, Y.-Q. Zhu, Y. Tohyama, K. Nagasaka: Preparation of non-linear optical properties of quantum-sized CuCl-doped silica glass by the sol-gel process. *J. Amer. Ceram. Soc.* 74 (1991)238-240.
36. M. Nogami, K. Nagasaka, E. Kato: Preparation of small particle-size, semiconductor CdS-doped silica glasses by the sol-gel process. *J. Amer. Ceram. Soc.* 73(1990)2097-2099.
37. John A. Dean : *Lange's Handbook of Chemistry*, 3rd edition. (1988)5-11.



APPENDICES

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



Appendix B

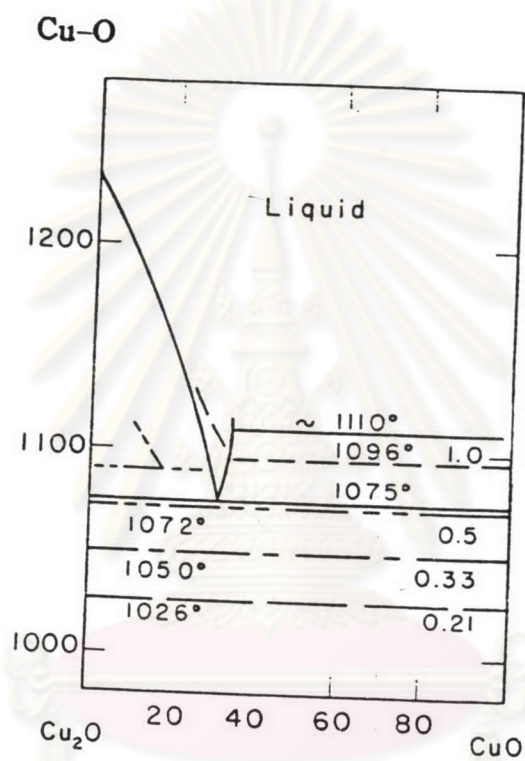


FIG. 2069.—System Cu₂O-CuO at various oxygen pressures. Solid lines are phase boundaries according to Vogel and Pöcher.

ศูนย์เทคโนโลยีสารสนเทศ
จุฬาลงกรณ์มหาวิทยาลัย

Appendix C

$$G = a_0 + a_1 \cdot T + a_2 \cdot T^2, \quad T \text{ in } 1000 \text{ K} \quad (*)$$

	a0	a1	a2	r ²
Cu	-0.04	6.54	4.50	1.000
Cu ₂ O	42.01	16.39	13.24	1.000
CuO	37.86	9.91	7.11	1.000
SiO ₂	215.90	10.58	8.17	1.000
SiO g	22.75	51.07	4.18	1.000
Si	0.26	2.48	4.52	0.999
O ₂	-0.72	49.54	4.02	1.000
H ₂	-0.71	31.84	3.64	1.000
H ₂ O g	57.08	45.31	4.84	1.000

Constants a_0 , a_1 , a_2 for the calculation of the Gibbs free energies $G^\circ(T)$ in kcal/mol of selected species after equation (*); r^2 = squared regression coefficient; the constants are valid in the interval 298-2,000 K

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