REFERENCES

1. Herman, J.C., and Leroy, V. Ferritic hot rolling and the potential for hot rolled and cold rolled products. Future of flat rolled steel production conference. 1995.
2. Biegus, C., Kaspar, R., and Lotter, U. Influence of thermomechanical treatment on the modification of austenite structure. Steel Research 65 No. 5 (1994): 173-177.
3. Böhme, D., Hensger, K.E., and Klimanek, P. Beitrag zur metallkundlichen Interpretation von Warmfließkurven. Neue Hütte 28 Jahrgang Heft 1 (Januar 1983): 15-20.
4. Sellars, C.M. Modelling microstructural development during hot rolling. Materials Science and technology 6 (1990): 1072-1081.
5. Hernandez, C.A., and Medina, S.F. General expression of the Zener-Holllomon parameter as a function of the chemical composition of low alloy and microalloyed steels. Acta mater. 44 No.1 (1996): 137-148.
6. Tamura, I. Some fundamental steps in thermomechanical processing of steels. Transaction ISIJ 27 (1987): 763-779.
7. Spittel, M., and Spittel, T. Berechnung des Einflusses der chemischen Zusammensetzung auf die Fließspannung von Stählen bei

Warmumformung. Neue Hütte 36 Jahrgang Heft9 (September 1991): 331.

8. Meyer, L. Grundlagen der Werkstoffentwicklung durch Verknüpfung thermischer und mechanischer Vorgänge beim Warmumformen. Stahl und Eisen 101 (1981): 486.

9. Bleck, W. ECSC-project "Thin slab casting". Annual report RWTH. 1996.

10...Karhausen, K., Kopp, R., and Souza, M. M., de. Numerical simulation method for designing thermomechanical treatments, illustrated by bar rolling. Scandinavian Journal of Metallurgy 20 (1991): 351-363.

11. Hirano, K., Kato, K., Saito, Y., and Sakai, T. Deformation and recrystallization behaviour of low carbon steel in high speed hot rolling. Transactions ISIJ 28 (1988): 1028-1035.

12. Karhausen, K., and Kopp, R. Model for integrated process and microstructure simulation in hot forming. Steel research 63 No. 6 (1992): 247-256.

13. Sellars, C.M. Modeling of structural evolution during hot working processes. 7th Ris∅ Int. Symposium on Metallurgical Science 1986 : 167-187.

14. Brimacombe, J.K., Jin, D.Q., Muojekwu, C.A., and Samarasekera, I.V. Thermomechanical history of steel strip during hot rolling: A comparison of conventional cold-charge rolling and hot-direct rolling of thin slabs. The Center for Metallurgical Process

Engineering, The University of British Columbia, Vancouver, B.C., Canada V6T 1Z4

15. Hernandez, C. A., and Medina, S. F. Modelling of the dynamic recrystallization of austenite in low alloy and microalloyed steels. Acta mater. 44 No.1 (1996): 165-171.

16. Groβheim, H. Personal note (1996) <Unpublished Manuscript>

17. Jonas, J.J., and Sakai, T. Dynamic recrystallization: Mechanical and microstructural considerations. Acta metall. 32 No. 2 (1984): 189-209.

18. Stüwe, H.P. Do metals recrystallize during hot working? Institut fur Werkstoffkunde und Herstellungsverfahren, Technische Hochschule, Braunschweig.

19. Sakai, T., Xu, Z., and Zhang, G.R. Effect of carbon content on static restoration of hot worked plain carbon. ISIJ International 35 No. 2 (1995): 210-216.

20. Gabrovsek, M., Vodopivec, F., and Zvokelj, J. Effects of finishing rolling temperature and carbon content on microstructure and mechanical anisotropy of 0.04-0.13%C steels. Transactions ISIJ 28 (1988): 117-124.

21. Sellars, C.M., and Whiteman, J.A. Recrystallization and grain growth in hot rolling. Metal Science March-April (1979): 188

22. Beynong, J.H., McLaren, A., and Sellars, C.M. Modelling of microstructural distribution during hot rolling of stainless steel. School of Materials, University of Sheffield, Sheffield Sl 3JD, UK (Mimeographed)

23. Sellars, C.M. Computer modelling of microstructural evolution during hot working. Metals Division, School of Materials, University of Sheffield, Mappin Street, Sheffield Sl 3 JD, UK

24. Glover, G., and Sellars, C. M. Static recrystallization after hot deformation of α iron. Metallurgical Transactions 3 (August 1972): 2271-2280.

25. Campbell, P.J., Gibbs, R.K., Hodgson, P.D., and Lee, M. Modelling of microstructural changes during the hot rolling of C-Mn steels. Thermec 88 (1988): 761-768.

26. Brimacombe, J.K., Hernandez, V.H., Jin, D.Q., Muojekwu, C.A., and Samarasekera, I.V. Hot-Direct rolling, runout table cooling and mechanical properties of steel strips produced from thin slabs. The Center for Metallurgical Process Engineering, Advanced Materials and Process Engineering Laboratory (AMPEL), The University of British Columbia, 111-2355 East Mall, Vancouver, B.C., Canada V6T 1Z4

27. Groβheim, H. Simulation of hot rolling in the ferrite range of steels. Journal of Materials Processing Technology 60 (1996): 613.

28. Gallagher, P.C.J. The influence of alloying, temperature and related effects on the stacking fault energy. Metallurgical Transactions. 1 (1970): 2429-2461.

29. Jonas, J.J., and McQueen, H.G. Recovery and recrystallization during high temperature deformation. Academic Press, San Francisco, 1975.

30. Gohda, S., Hashimoto, Y., and Watanabe, K. Effects of the intercritical rolling on structure and properties of low carbon steel. Transactions ISIJ 21 (1981): 6-15.

31. Bleck, W., Feldhaus, S. and Gupta, I. Processing, properties and fabrication of ultra-low-carbon steels. Continuing education short course at MWSP'97, 1997.

32. Beco, F., Harlet, Ph., Herman, J.C., Leroy, V., Messien, P., and Renard, L. Continuous annealing of ULC-Ti ferritic hot rolled strips. The Minerals, Metals & Materials Society (1992): 287-304.

33. Bleck, W., and Esser, J.-J. Metallurgical effects of charging procedures in hot strip mills on the properties of cold formable steels. In R. Tomellini (ed.), European steelmaking development and perspectives in rolling and reheating, pp. 41-52. Luxembourg: Office for Official Publications of the European Communities, 1995.

34. Herman, J.C., and Messien, P. r-value improvement of steel product using hot-rolling lubricant. The Minerals, Metals & Materials Society. 1993.

35. Cetlin, P. R., Jonas, J.J., and Yue, S. Simulated rod rolling of interstitial free steels. ISIJ International 33 No. 4 (1993): 495.

36. Herman, J.C., and Leroy, V. The microstructure and properties of steel processed by thin slab casting. Microalloying 95 (1995b)

37. Lenard, J.G. Modelling hot deformation of steels. Germany: Springer-Verlag, Berlin Heidelberg. 1989.

38. Moore, P. Methods for studying hot workability: Acritical assessment. The Central Research Laboratories, Richard Thomas & Baldwins Ltd, Whitchurch, Aylesbury, Bucks.

39 Backmann, G., Kaspar, R., Müller, P.M., and Philipp, F.D. Hot stress-strain curves of steel determined by different kinds of deformation. Steel Research 64 No. 12 (1993): 611-617.

40. Jonas, J.J., Najafi-Zadeh, A., and Yue, S. Grain refinement by dynamic recrystallization during the simulated warm-rolling of interstitial free steels. Metallurgical Transactions 23A (1992): 2607-2617.

41. Bleck, W., Bode, R., and Feld, A. Entwicklung einer neuen Kaltbandsondertiefziehgüte aus unlegiertem Stahl. Stahl und Eisen 114 Nr.3 (1994): 61-67.

42. Hansen, S.S., and Speer, J.G. Austenite recrystallization and carbonitride precipitation in niobium microalloyed steels. Metallurgical Transactions 20A (1989): 27.

Appendixes

Flow Curves

Effect of Deformation Temperature and Strain Rate on the Critical Flow Stress

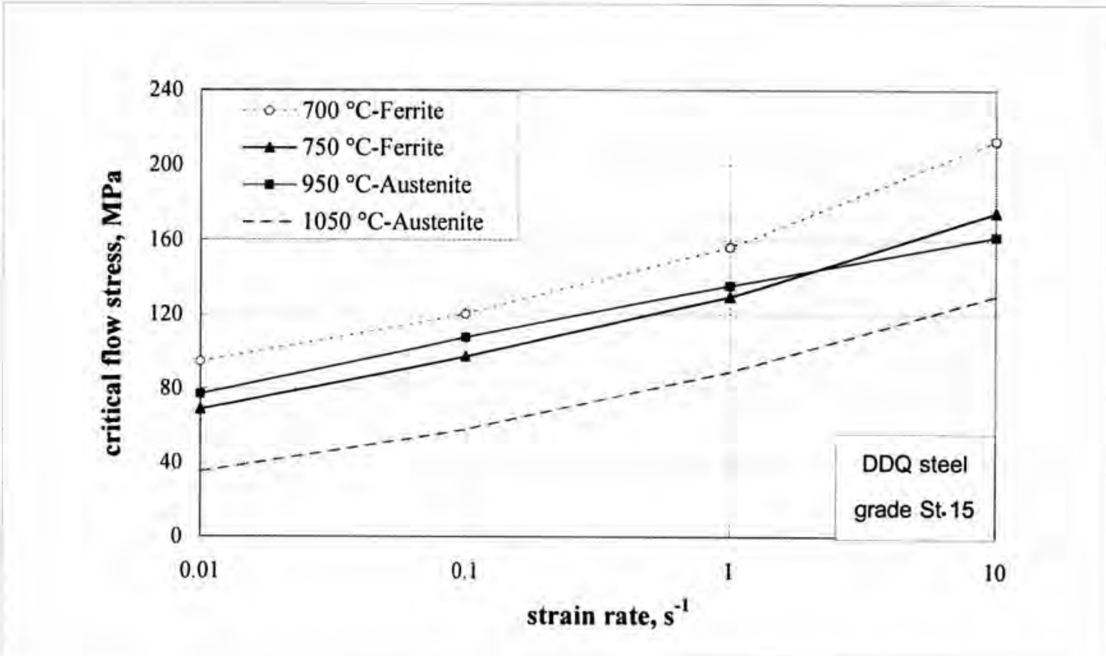

Fig. A1 : Effect of deformation temperature and strain rate on the critical flow stress of St.15 (austenitizing at 1250 °C for 10 minutes)

Effect of Deformation Temperature and Austenitizing Condition on the Critical Flow Stress

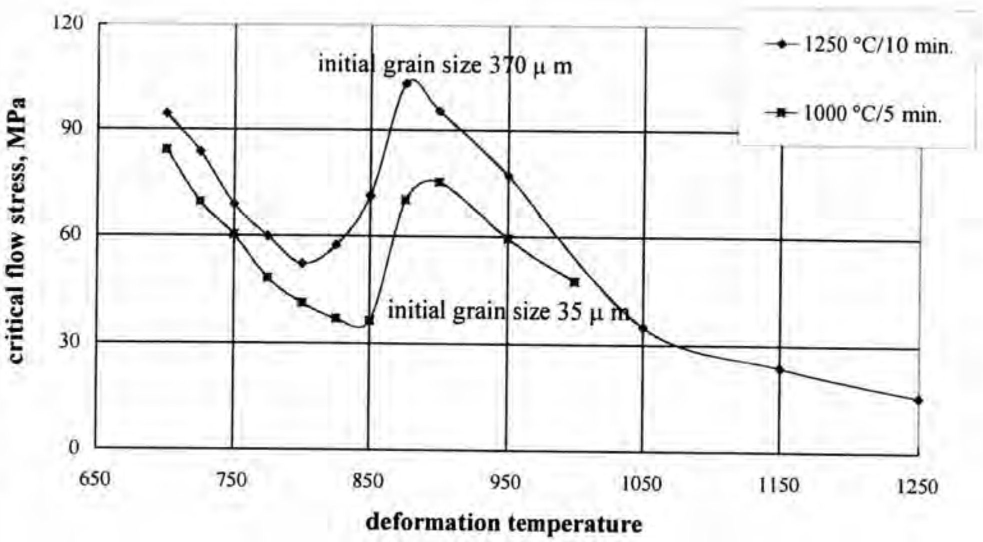

Fig. A2 : Effect of deformation temperature and austenitizing condition on the critical flow stress of St.15 (a constant strain rate of 0.01/s)

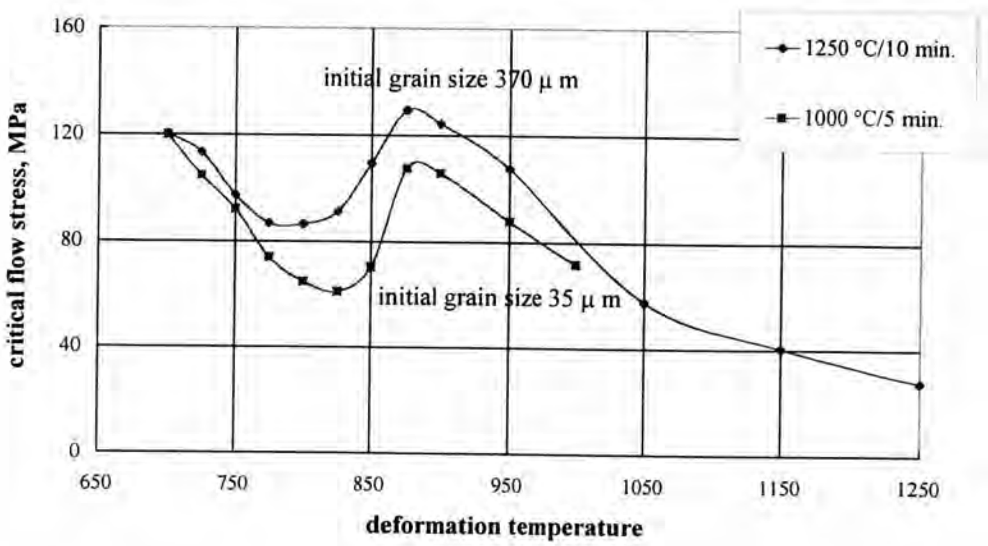

Fig. A3 : Effect of deformation temperature and austenitizing condition on the critical flow stress of St.15 (a constant strain rate of 0.1/s)

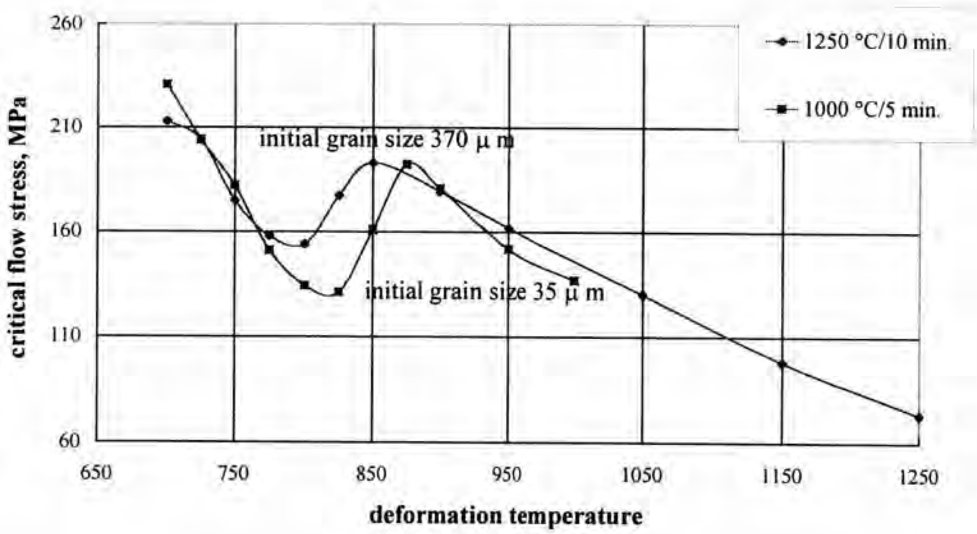

Fig. A4 : Effect of deformation temperature and austenitizing condition on the critical flow stress of St.15 (a constant strain rate of 10/s)

Effect of Deformation Temperature on the Stress-strain Curves of St.15 (Deformation Temperature in Austenitic Range)

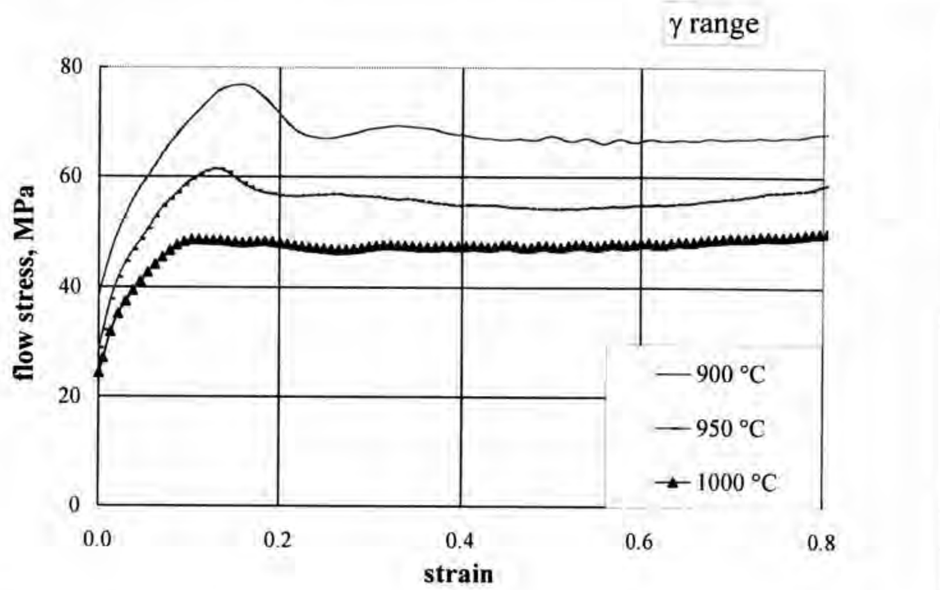

Fig. A5 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.01/s (austenitizing at 1000 °C for 5 minutes)

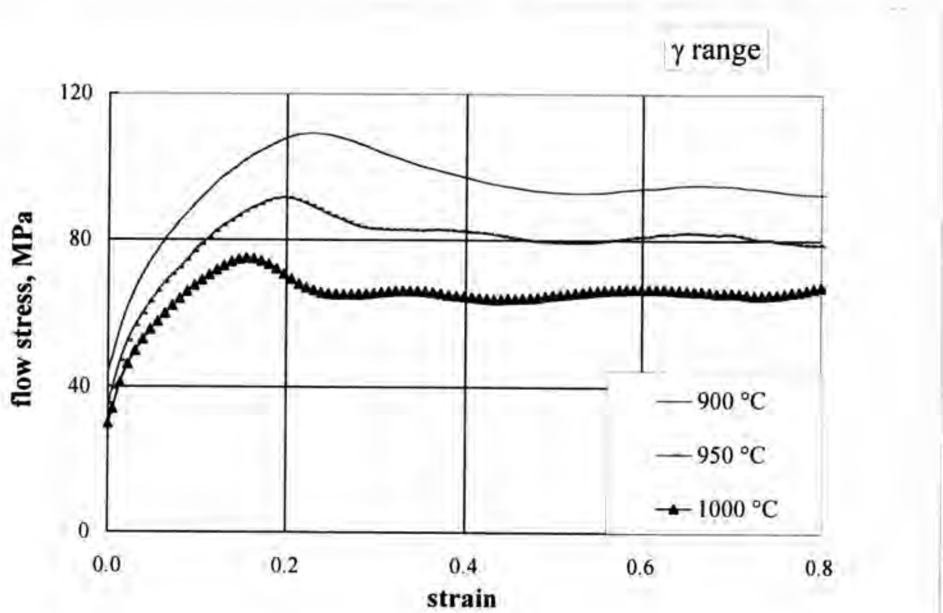

Fig. A6 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.1/s (austenitizing at 1000 °C for 5 minutes)

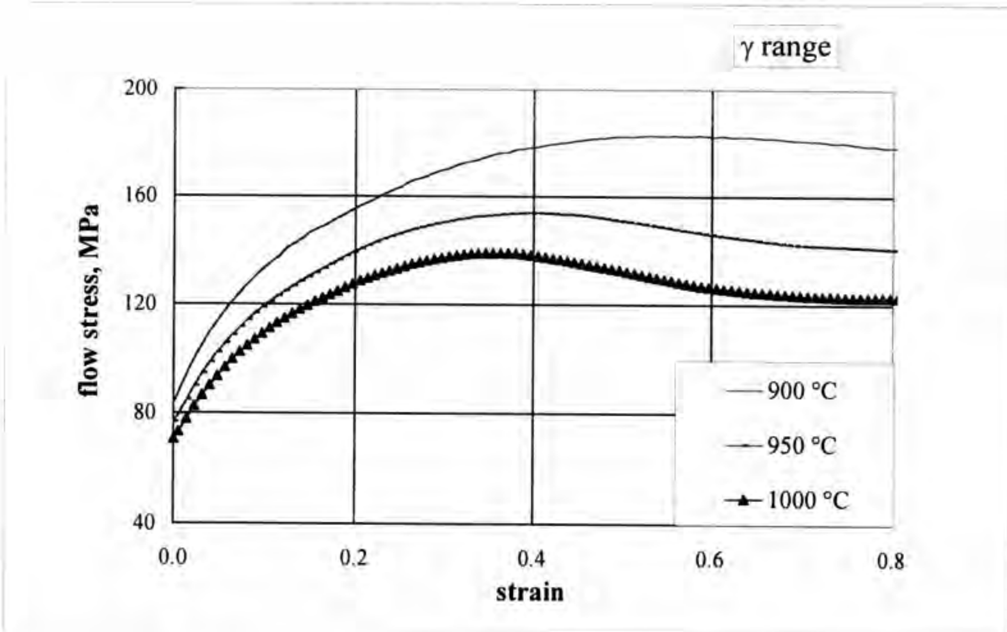

Fig. A7 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 10/s (austenitizing at 1000 °C for 5 minutes)

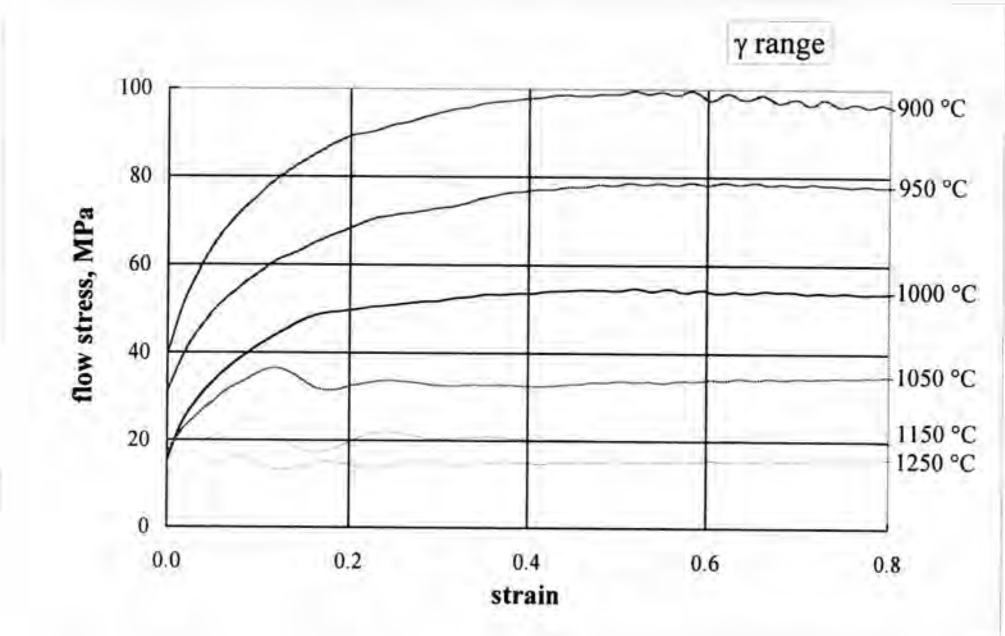

Fig. A8 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.01/s (austenitizing at 1250 °C for 10 minutes)

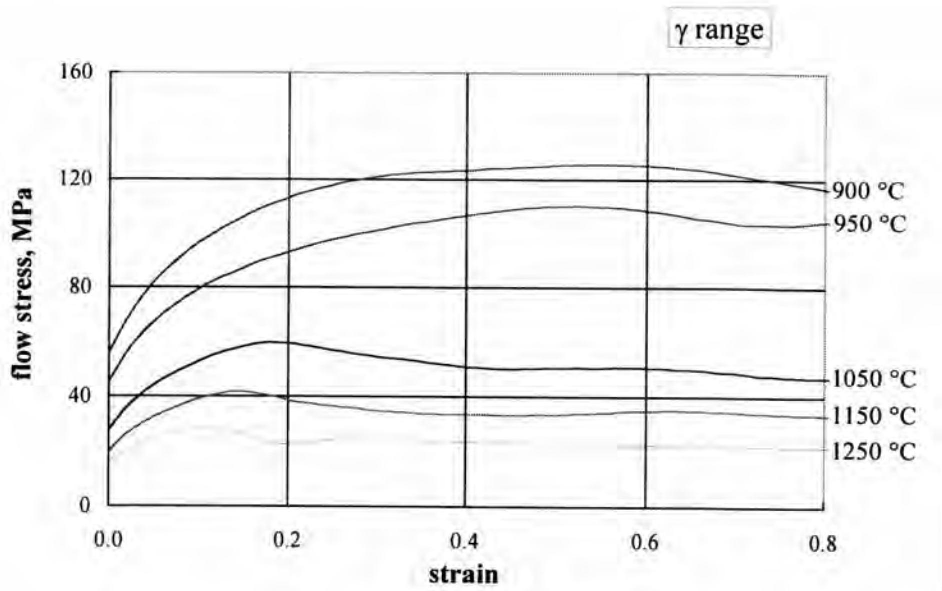

Fig. A9 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.1/s (austenitizing at 1250 °C for 10 minutes)

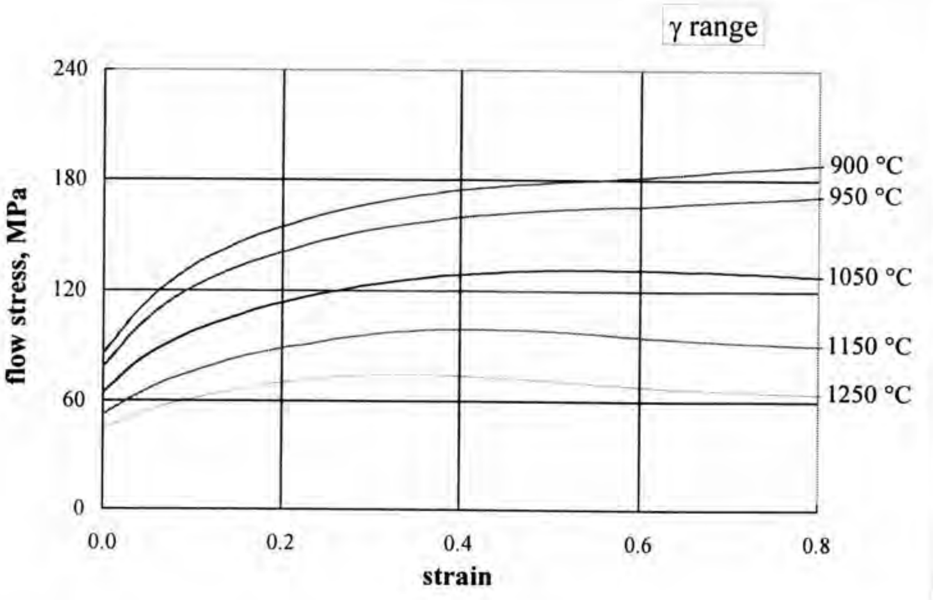

Fig. A10 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 10/s (austenitizing at 1250 °C for 10 minutes)

Effect of Deformation Temperature on the Stress-strain Curves of St15 (Deformation Temperature in Ferritic Range)

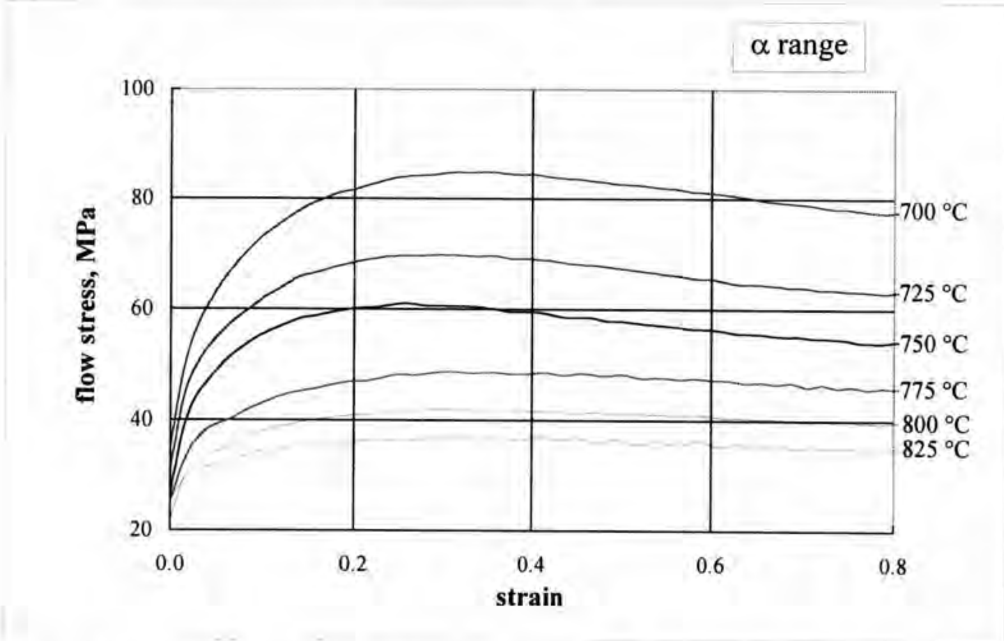

Fig. A11 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.01/s (austenitizing at 1000 °C for 5 minutes)

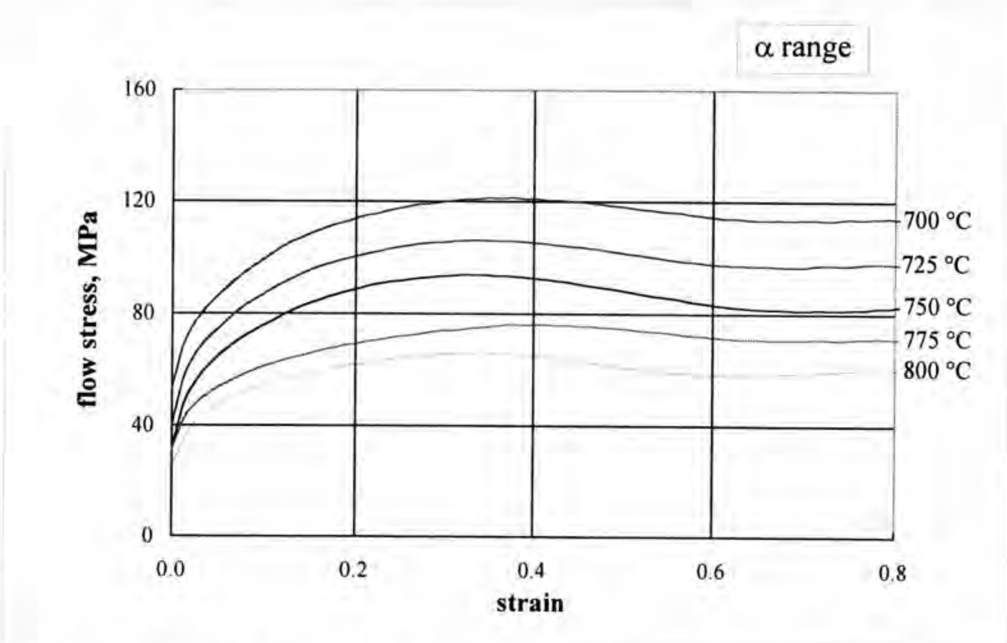

Fig. A12 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.1/s (austenitizing at 1000 °C for 5 minutes)

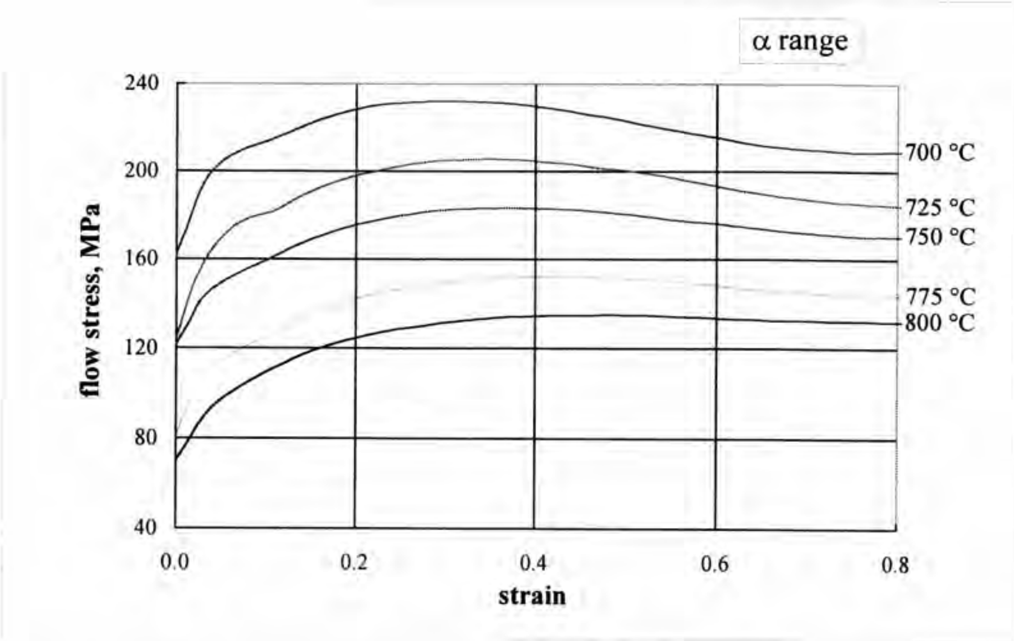

Fig. A13 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 10/s (austenitizing at 1000 °C for 5 minutes)

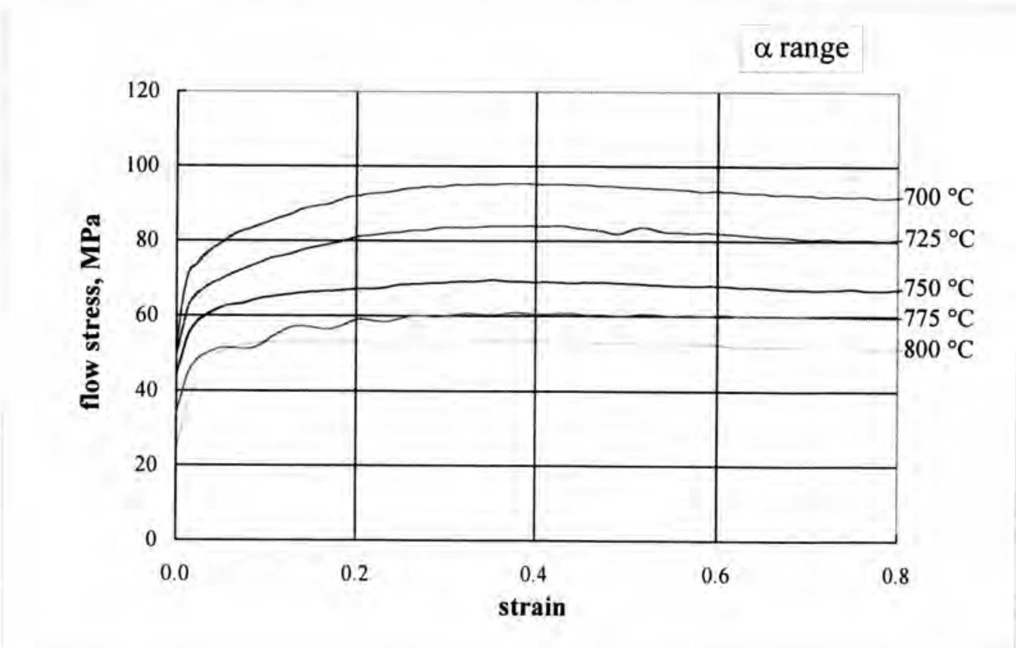

Fig. A14 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.01/s (austenitizing at 1250 °C for 10 minutes)

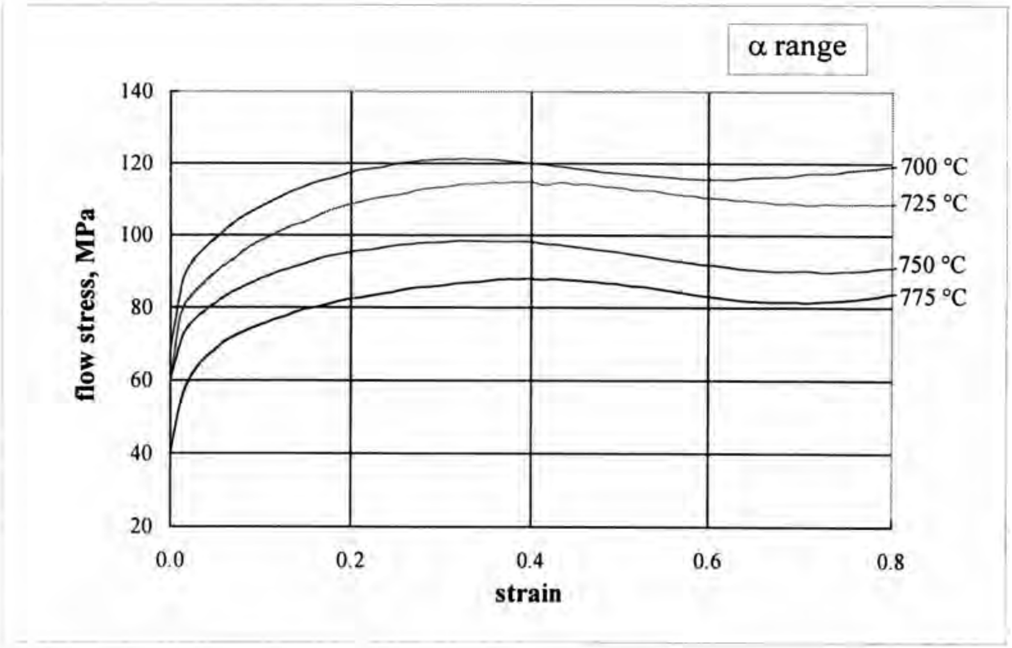

Fig. A15 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 0.1/s (austenitizing at 1250 °C for 10 minutes)

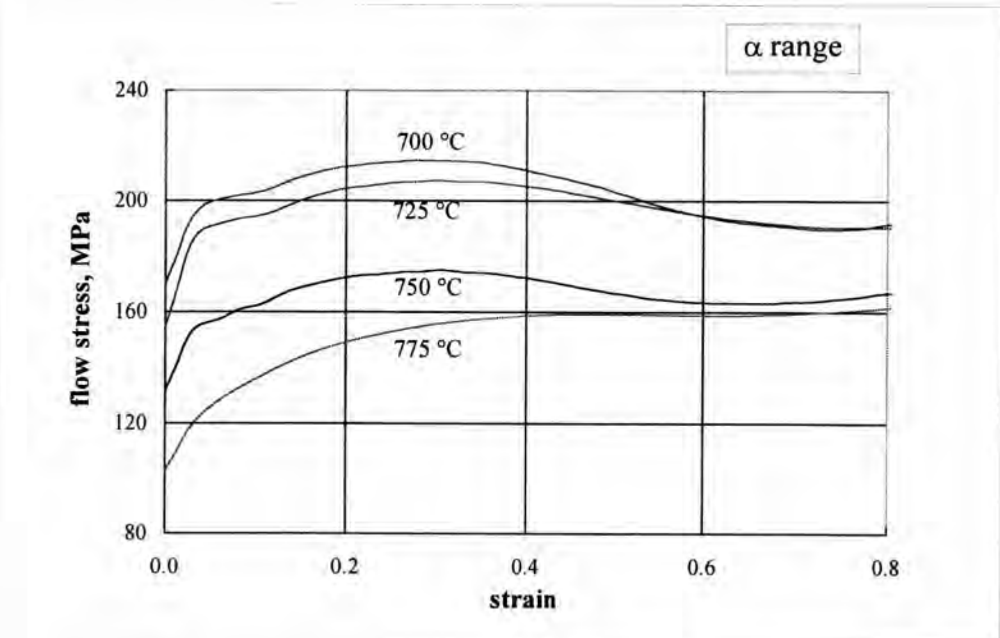

Fig. A16 : Effect of deformation temperature on the stress-strain curves of St.15 at a constant strain rate of 10/s (austenitizing at 1250 °C for 10 minutes)

Effect of Strain Rate on the Stress strain Curves of St.15

(Deformation Temperature in Austenitic Range)

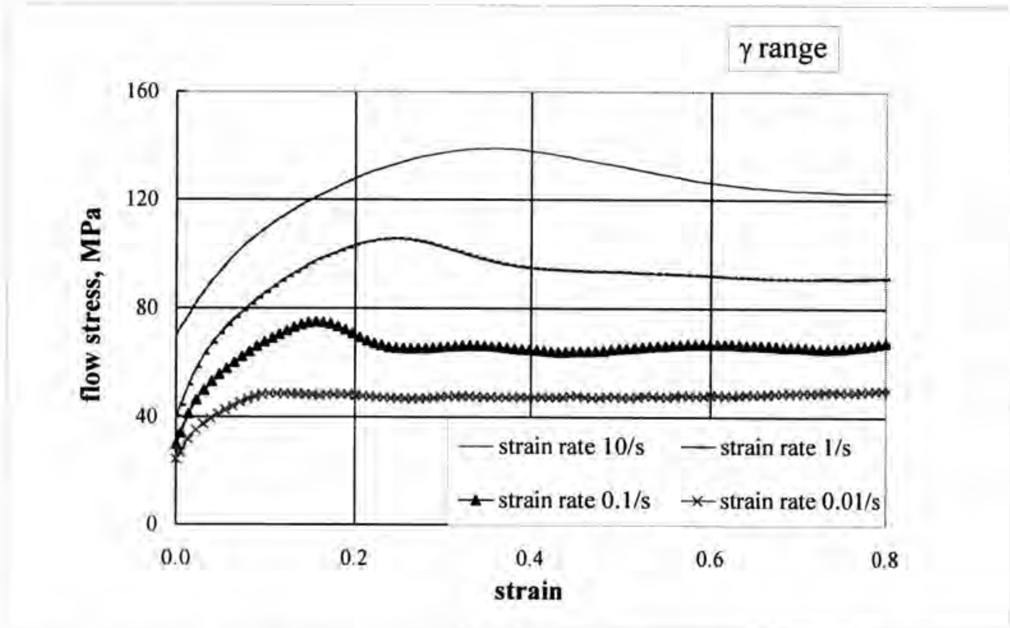

Fig. A17 : Effect of strain rate on the stress-strain curves of St.15 at 1000 °C (austenitizing at 1000 °C for 5 minutes)

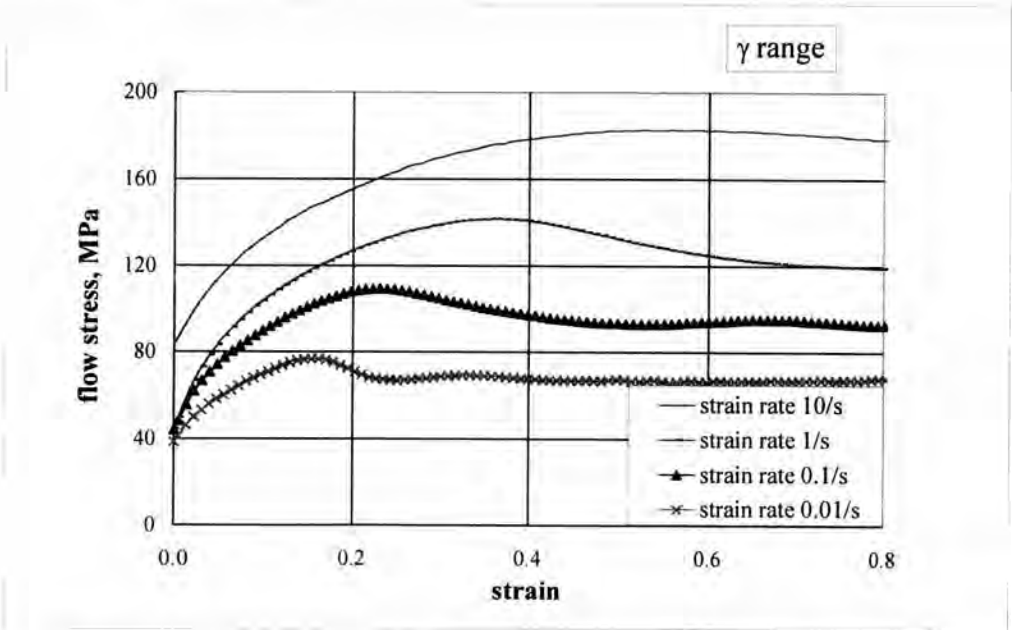

Fig. A18 : Effect of strain rate on the stress-strain curves of St.15 at 900 °C (austenitizing at 1000 °C for 5 minutes)

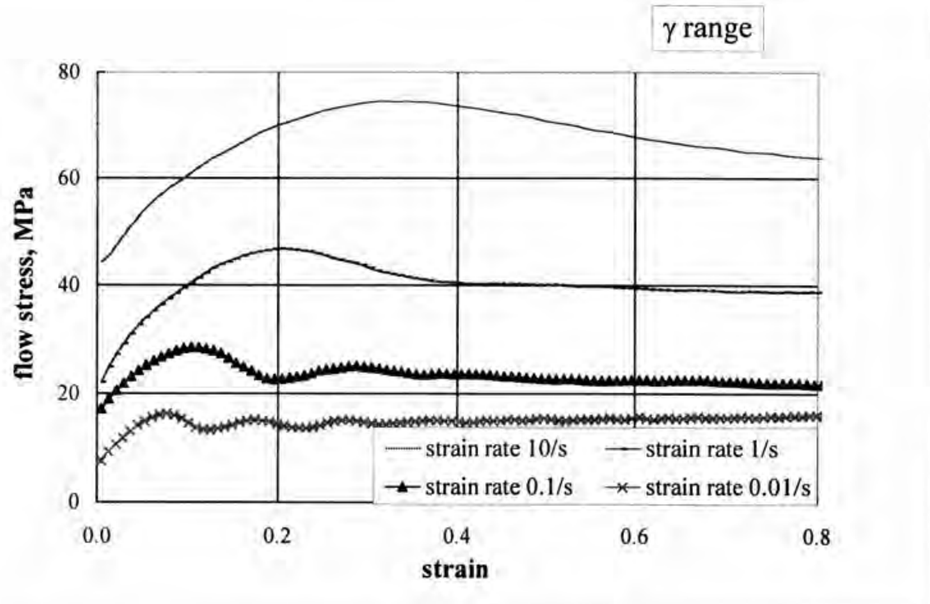

Fig. A19 : Effect of strain rate on the stress-strain curves of St.15 at 1250 °C (austenitizing at 1250 °C for 10 minutes)

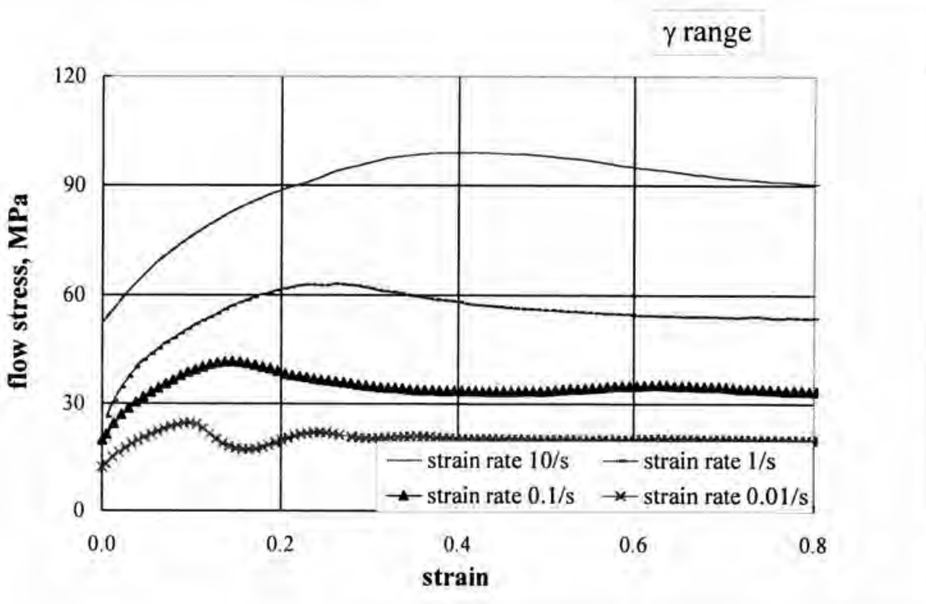

Fig. A20 : Effect of strain rate on the stress-strain curves of St.15 at 1150 °C (austenitizing at 1250 °C for 10 minutes)

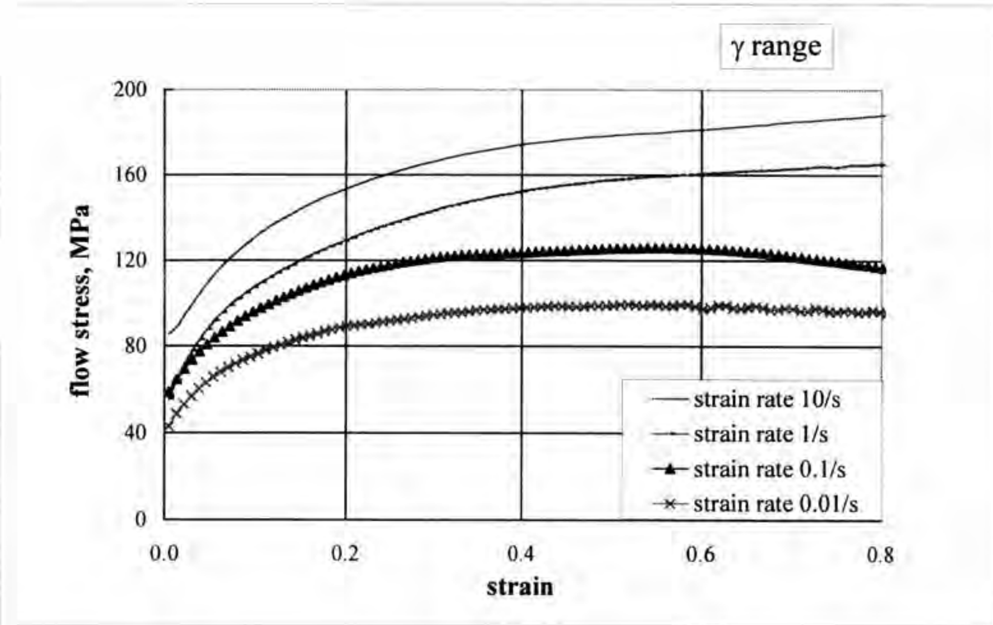

Fig. A21 : Effect of strain rate on the stress-strain curves of St.15 at 900 °C (austenitizing at 1250 °C for 10 minutes)

Effect of Strain Rate on the Stress strain Curves of St15

(Deformation Temperature in Ferritic Range)

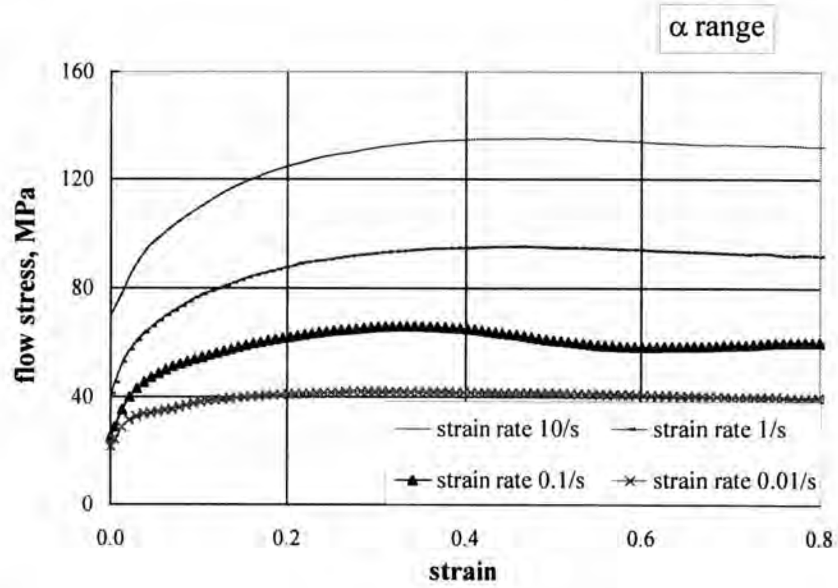

Fig. A22 : Effect of strain rate on the stress-strain curves of St.15 at 800 °C (austenitizing at 1000 °C for 5 minutes)

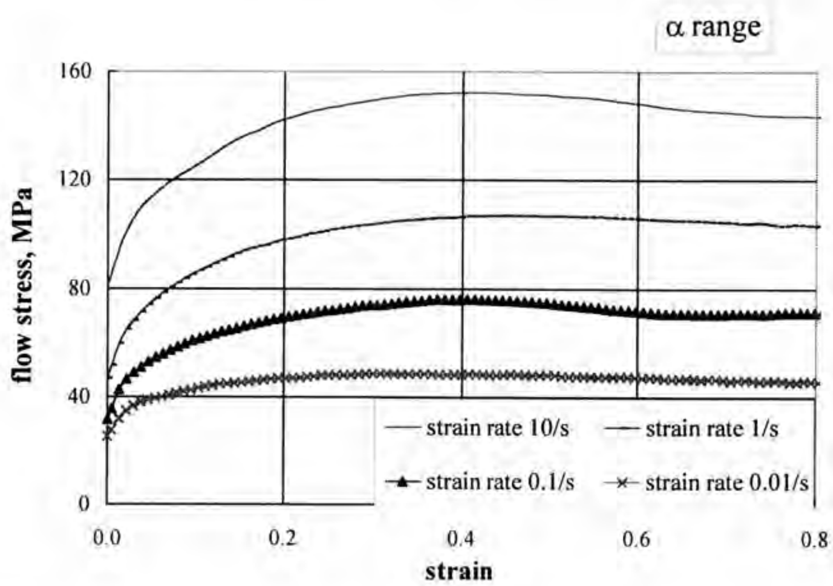

Fig. A23 : Effect of strain rate on the stress-strain curves of St.15 at 775 °C (austenitizing at 1000 °C for 5 minutes)

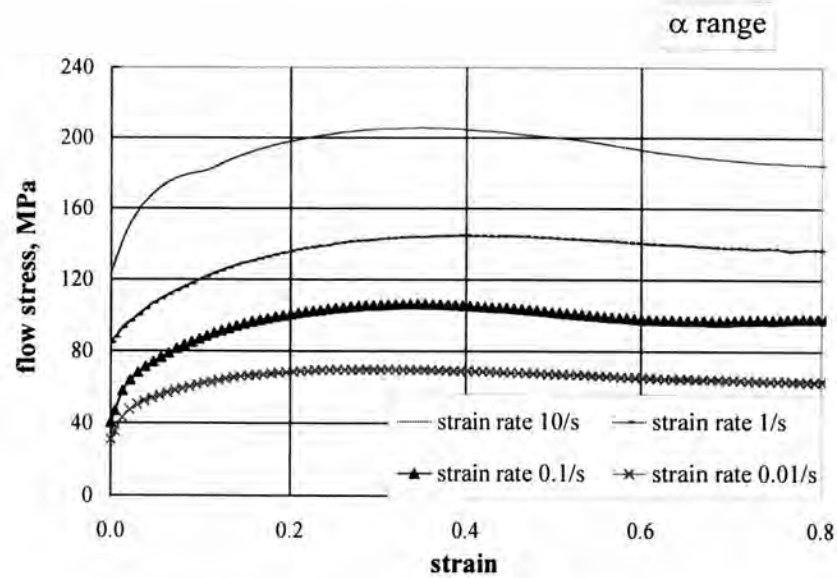

Fig. A24 : Effect of strain rate on the stress-strain curves of St.15 at 725 °C (austenitizing at 1000 °C for 5 minutes)

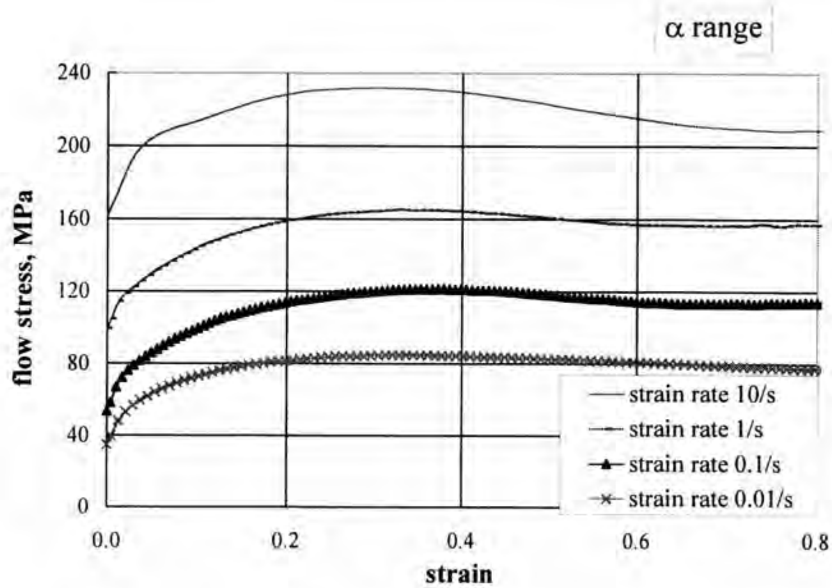

Fig. A25 : Effect of strain rate on the stress-strain curves of St.15 at 700 °C (austenitizing at 1000 °C for 5 minutes)

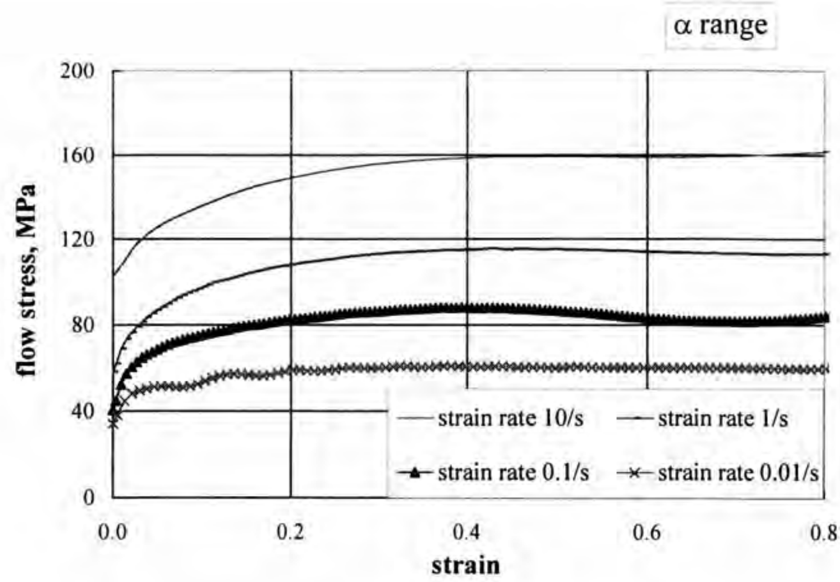

Fig. A26 : Effect of strain rate on the stress-strain curves of St.15 at 775 °C (austenitizing at 1250 °C for 10 minutes)

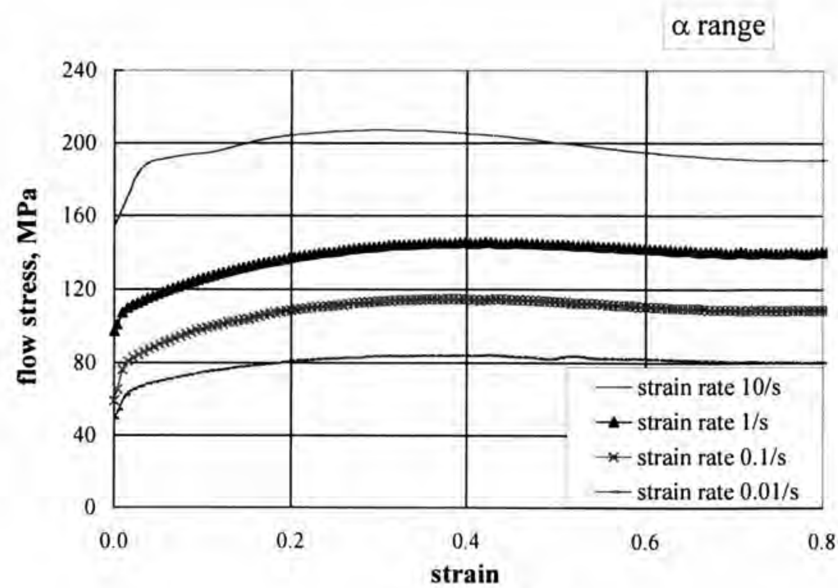

Fig. A27 : Effect of strain rate on the stress-strain curves of St.15 at 725 °C (austenitizing at 1250 °C for 10 minutes)

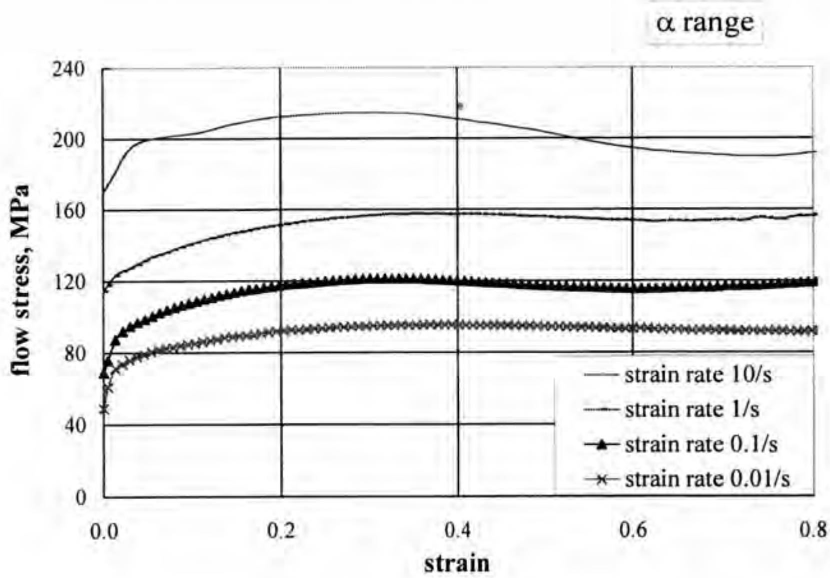

Fig. A28 : Effect of strain rate on the stress-strain curves of St.15 at 700 °C (austenitizing at 1250 °C for 10 minutes)

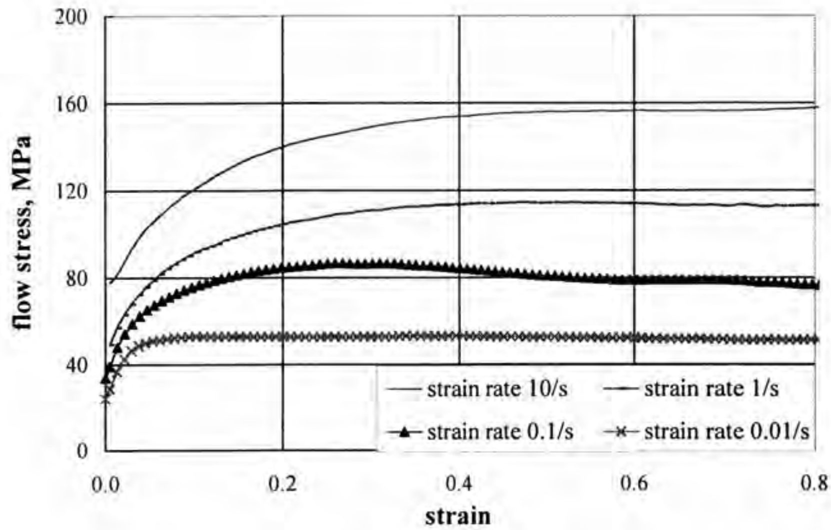

Fig. A29 : Effect of strain rate on the stress-strain curves of St.15 at 800 °C (austenitizing at 1250 °C for 10 minutes)

BIOGRAPHY

Mr. Kriangyut Phiu-on was born on January 19, 1973 in Samutprakarn, Thailand. He received a B. Eng. (Metallurgy) from Chulalongkorn University in 1994. He began his study for a master degree in Metallurgical Engineering at Chulalongkorn University in 1994.