



## Application of Newly Developed Heat Resistant Materials for USC Boilers

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30<sup>th</sup> MPA-Seminar in conjunction with the 9<sup>th</sup> German-Japanese Seminar

Stuttgart, October 6 and 7, 2004



\*DE021057346\*

### Abstract

This paper describes the research on the development and improvement of new high strength heat resistant steels such as SUPER304H (18Cr-9Ni-3Cu-Nb-N), NF709 (20Cr-25Ni-1.5Mo-Nb-Ti-N) and HR3C (25Cr-20Ni-Nb-N) as boiler tube, and NF616 (9Cr-0.5Mo-1.8W-Nb-V) and HCM12A (11Cr-0.4Mo-2W-Nb-V-Cu) as thick section pipe. The latest manufacturing techniques applied for these steels are introduced. In addition the high temperature strength of Alloy617 (52Ni-22Cr-13Co-9Mo-Ti-Al) that is one of the candidate materials for the next generation 700°C USC boilers is described.

### 1. Introduction

In recent years steam temperature and pressure of thermal power plants have been raised to achieve higher plant efficiency as shown in Figure 1. To meet the demand new heat resistant steels with high creep rupture strength have been developed in Japan such as SUPER304H(18Cr-9Ni-3Cu-Nb-N), NF709(20Cr-25Ni-1.5Mo-Nb-Ti-N) and HR3C(25Cr-20Ni-Nb-N) as boiler tube, and NF616(9Cr-0.5Mo-1.8W-Nb-V) and HCM12A(11Cr-0.4Mo-2W-Nb-V-Cu) as thick section pipe[1]. Most of them were code specified in Japan and the U.S.. They realized the Ultra Super Critical (USC) boilers with high steam condition of 25MPa/600°C and now several 1,000MW USC power plants are being operated in Japan and Europe[2]. Sumitomo Metals Industries or Nippon Steel Corporation has developed these steels originally but some of them had been improved in material properties for better boiler application. This paper describes the research on the development and improvement of these new steels and the latest manufacturing techniques applied for these steels as boiler main components. Then the high temperature strength and the weldability of Alloy617 (52Ni-22Cr-13Co-9Mo-Ti-Al) that is one of the candidate materials for the next generation 700°C USC boilers are described.