19. 0.15C-1.5Mn-1.5Si계 TRIP형 냉연강판의 Cu함량에 따른 기계적 특성

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In recent years considerable researches have been carried out on the development of high strength steels for applications in automotive industry. The main issues are to reduce weight and increase safety of vehicles by use of high strength and high ductility steels. Among the candidates, so-called TRIP(Transformation Induced Plasticity)-aided multi-phase steels have been regarded as one of the most promising materials due to their excellent combinations of strength and ductility. The high formability of these transforms to martensite by plastic deformation. To lessen economic and environmental burdens, development of TRIP steels have been focused on the investigation of less expensive grades with simple constituents, such as C-Mn-Si steels. In low-alloyed C-Mn-Si TRIP steels, the austenite is stabilized by C and partly by Mn, and cementite formation during isothermal bainitic transformation is suppressed by Si. In order to further improve mechanical and galvanizing properties, or substituted to Si in the conventional, C-Mn-Si TRIP steels.

Cu as austenite stabilizer is not soluble in cementite like Si, and it has been known that Cu showed beneficial roles in strengthening steels through various mechanism such as, solid solution hardening, refinement of ferrite grain size and precipitation hardening. Therefore, Cu is expected to be an effective alloying element in TRIP-aided steels.

In the present study, effects of copper addition to the C-Si-Mn TRIP-aided multi-phase steels on the mechanical properties, amount of retained austenite and its stability subjected to plastic deformation have been investigated. Three kinds of steels whose basic composition is 0.15C-1.5Mn-1.5Si, ECO-A(no Cu addition), ECO-B(0.5wt.%Cu) and ECO-C(1.0wt.%Cu), respectively, were fabricated according to the conventional two stage treatment at slightly above Ms temperature. Microstructure observation and mechanical tests were carried out, and variations of fraction of retained austenite with straining were determined by X-ray diffraction measurement.

In the three type of steels employed in this study, typical microstructures of TRIP-aided multi-phase steels, which were composed of ferrite, bainite and retained austenite were well developed, and amount of retained austenite were increased with increasing Cu content. Tensile strength was increased with an addition of Cu, however, ductility did not show monotonic increase with Cu contents. In the 1.0wt.% Cu-added steel, amount of retained austenite was increased but its stability with straining is decreased, which caused to high strength with low ductility. However, in the 0.5wt.% Cu-added steel, stability of retained austenite did not show severe variation against plastic deformation, which was effective to utilize TRIP effect and leaded to good strength and ductility balance. It is concluded that strength of the TRIP

steel is closely related to amount of retained austenite stabilized at room temperature. In addition, martensite formed after cooling from heat treatment might be affect strength of the TRIP steels, which need further study. And it is shown that the stability if the retained austenite is the most important factor governing ductility level of the TRIP steels rather than its volume fraction.

20. 해수 열원 열펌프 압축기의 액분사 효과에 대한 실험연구

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본 연구는 해수 열원 열펌프 압축기의 액분사 효과에 대한 실험적 연구이다. 현재 에너지 절약과 환경보호의 목적으로 열펌프 시스템 성능향상을 위한 다각적인 기술들이 개발되고 있다. 그 일부로서 압축기 실린더 내부에 냉매액을 직접 분사한 효과는 높은 승온폭으로 인해 발생하는 냉매나 냉동유의 열화를 방지하고 압축기 토출 유량을 증가시켜 응축기 방열량을 증가시킨다. 이러한 연구는 공기압축기에도 적용된 바가 있으며, 선행연구가에 의해 수치적, 실험적으로 수행되어 왔으나 왕복동식 압축기를 적용한 실험적 시스템 분석사례는 없었다. 본 연구에서는 미활용 에너지인 해수를 열원으로 이용하고 상용압축기에 액분사부를 도입한 열펌프를 제작하여 실험을 수행하였고, 결과 토출온도의 감소와 시스템의 성능향상을 도모할 수 있었다.

21. 標準畵像을 利用한 2次元 PIV와 3次元 PIV (스테레오 PIV) 計測 및 性能比較檢定에 관한 硏究

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압축성 혹은 비압축성 열유체유동장의 해석을 위해서는 유동장의 물리량인 속도 3성분 (u, v, w), 압력 (P), 온도 (T)에 관한 정보가 전 공간에 걸쳐서 얻어져야 한다. 이를 구현할 수 있는 방법으로서 수치계산적 방법과 순수실험적 방법을 들 수 있다. 즉, CFD (Computational Fluid Dynamics)에 의하여 유동을 예측하는 방법과 실험적 계측도구를 이용하여 유동을 예측하는 방법이 있다.

CFD에 의한 방법은 계산기의 성능한계로 해석대상에 따라 유동의 지배방정식에 대한 구속조