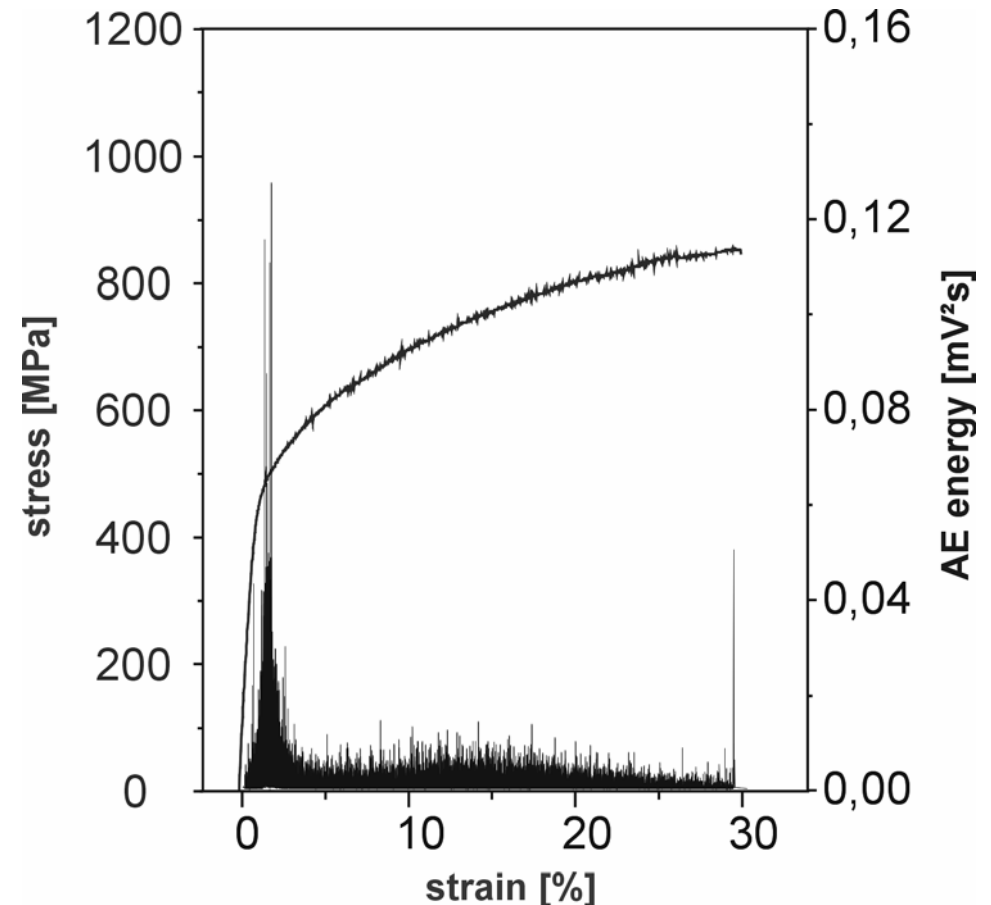


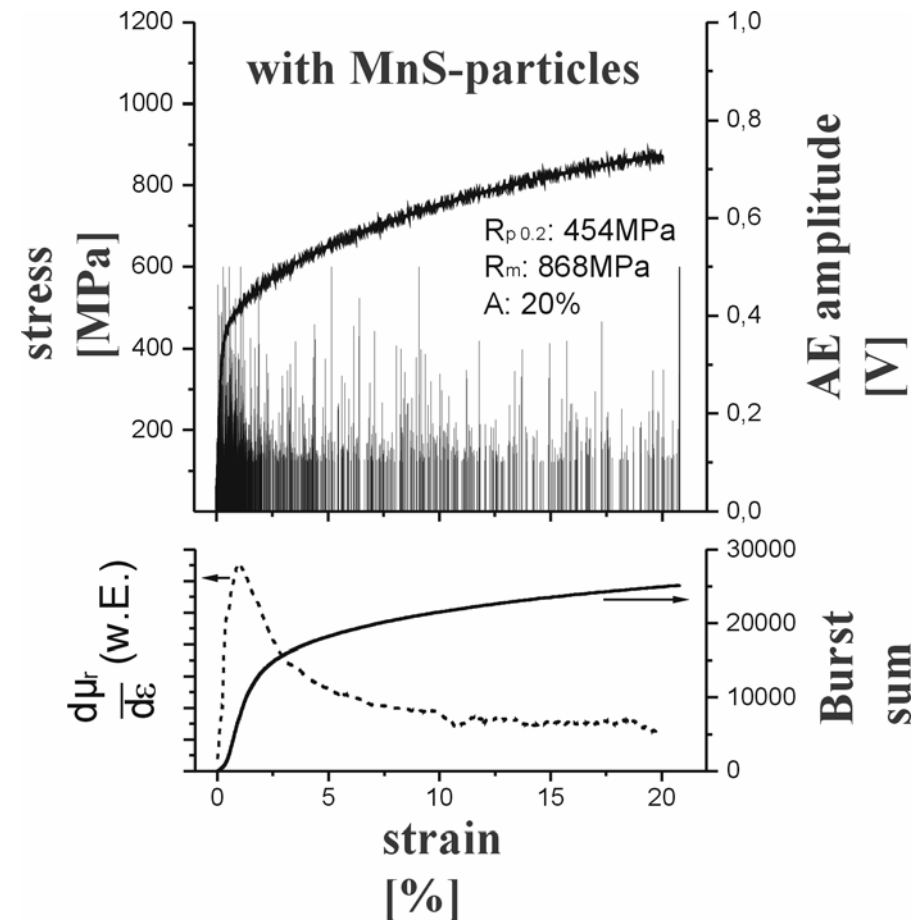
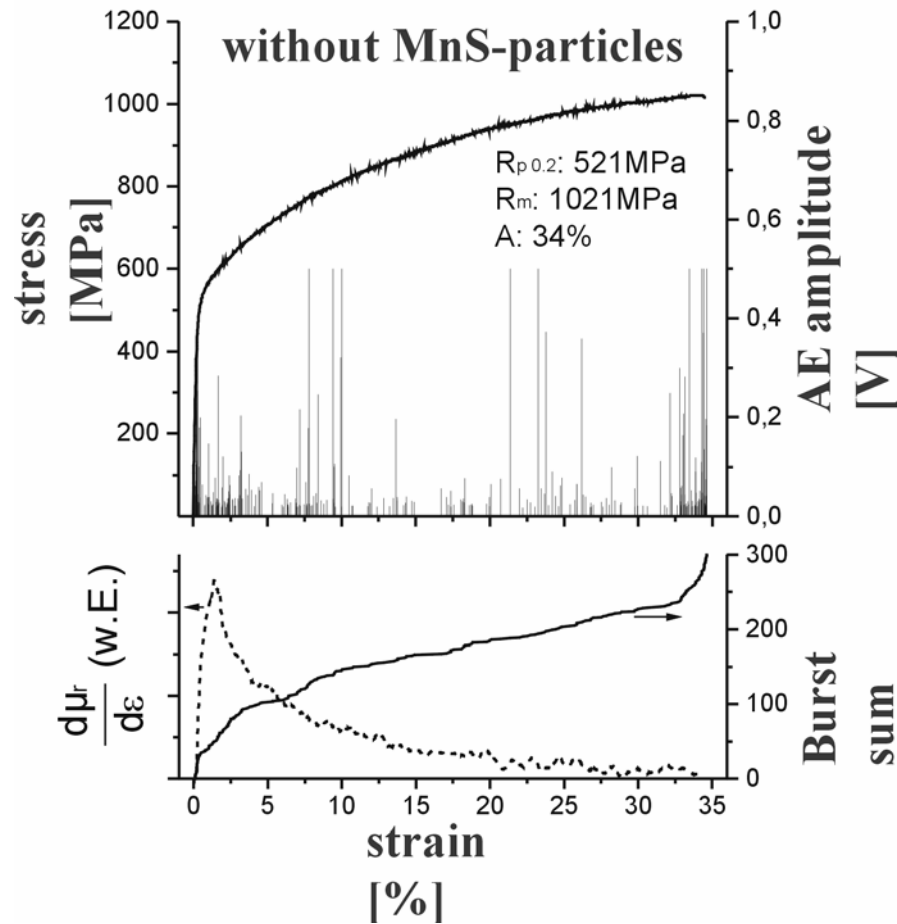
## **Motivation, Objective**

- **TRIP steels are adaptive materials. They are characterized by high fracture toughness and local hardening under high loads.**
- **The local hardening effect is based on the formation of martensite disks and guarantees a high tensile strength.**
- **Martensite takes a smaller volume than ferrite. Therefore the formatted martensite disks loosen partially from the ferrite matrix and generate acoustic emission events.**
- **In standard TRIP steel most of the acoustic emission events arise directly at the yield point. After exceeding of the yield point the AE activity is very small.**
- **However, an advantage of this steel consists in the fact that it is loadable locally far beyond yield point. In this region an AE monitoring is especially interesting.**
- **Therefore one main purpose of the investigation was to search for material structures which effect an increasing of AE activity after the yield point.**

## Solution

- Bringing in hard particles increases the AE activity after exceeding of the yield point.
- Applicable hard particles are manganese sulfides (MnS), glasses and ceramics.
- During the production process the steel undergoes a strong cold forming. In this process the hard particles must not be destroyed.
- In order not to affect the material properties of TRIP steel negatively, a small number and a uniform distribution are necessary. That can be achieved best by a powder metallurgy manufacturing process.

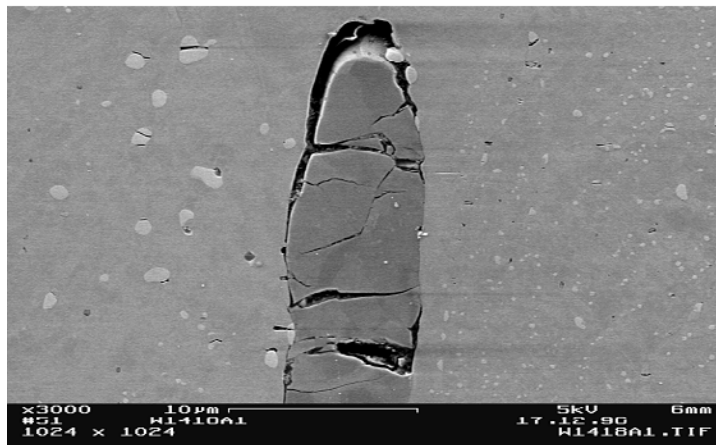
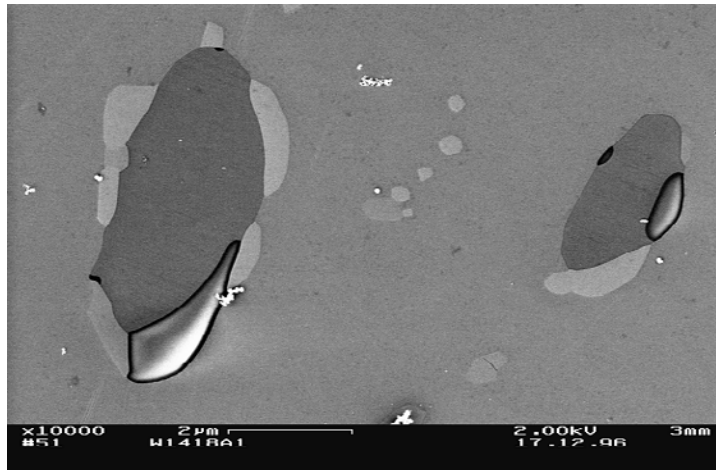




The AE activity after exceeding of the yield point can be insignificantly increased by a changed thermal treatment of the steel.

Bringing in MnS-particles leads to a significant increasing of the AE activity after exceeding of the yield point.

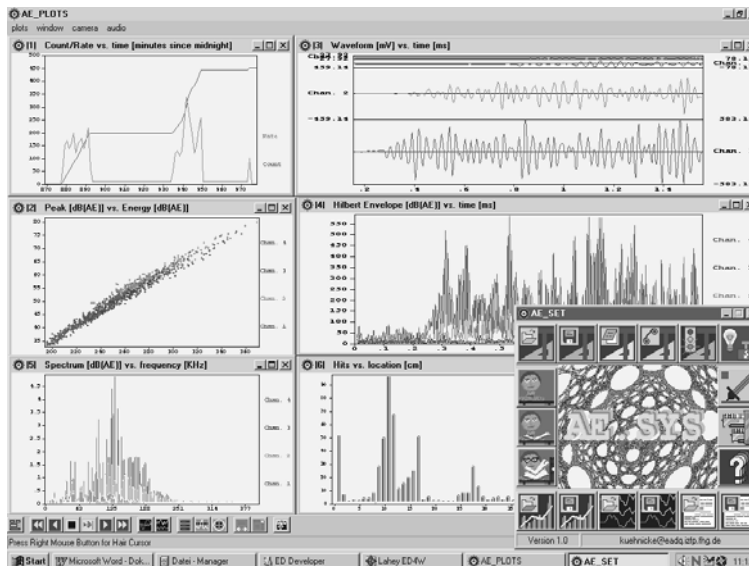




**Raster-electronic images of individual MnS-inclusions before (above) and after (down) the load**



**Microstructure of TRIP steel. The so-called martensite disks are black.**



## Data acquisition system

**AE.engine with DSP-Board  
20 MHz sample rate**

