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Investigation on properties and microstructure in hot stamping operation of rear axle beams

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Contents

Development of automobile industry

Problem

The rapid development of automobile brings problems and challenges: including problems of transportation, security environment, resource, and so on

Develop green, safe and low-price car

Energy

Use of alternative energy such as hydrogen, electric, hybrid and other energy.

Such as:
Roewe 550c (hybrid car),
Tesla (electric vehile) and etc.

Lightweight

ULSAB-AVC

↓

ABC / NSC

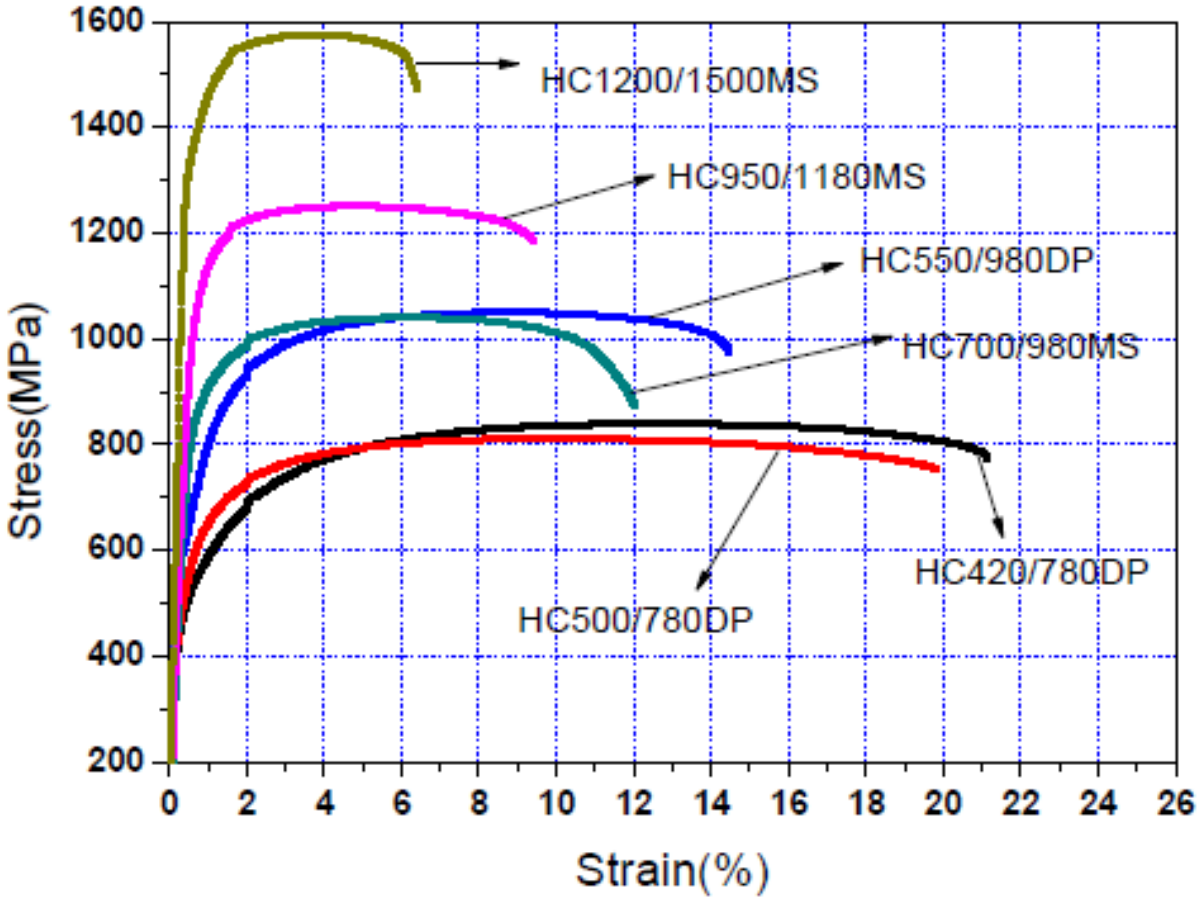
↓

ULSTEEL xx

↓

Next Generation

Development of automobile industry



Experimental Materials

22MnB5

A very small amount of boron will be gathered into the austenite grain boundaries, ferrite nucleation is delayed and thus preventing the formation of ferrite in the process.

1. The boron located in the austenite grain boundaries reduces the interfacial energy of the austenite grain boundaries
2. $Fe_{23}(CB)_6$ delay the formation of ferrite nucleation

22MnB5, is a manganese boron steel, the chemical composition of the steel is a certain amount of boron alloy added on the basis of carbon fierce.

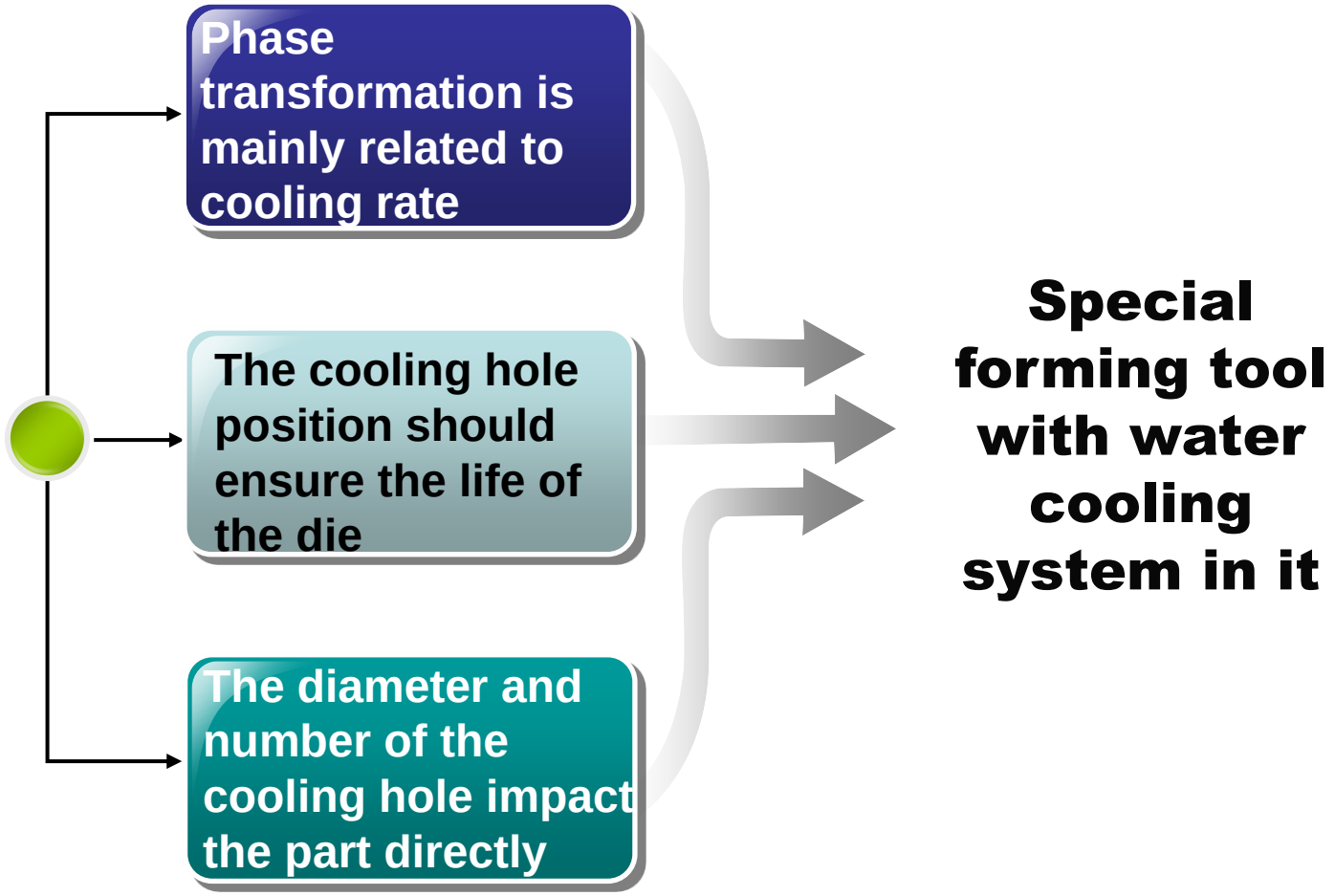
After hot stamping, the material YS can reach about 1100MPa, TS can reach about 1500MPa and hardness can reach 50HRC, increased about 2 to 3 times higher than the original state.

Experimental Materials

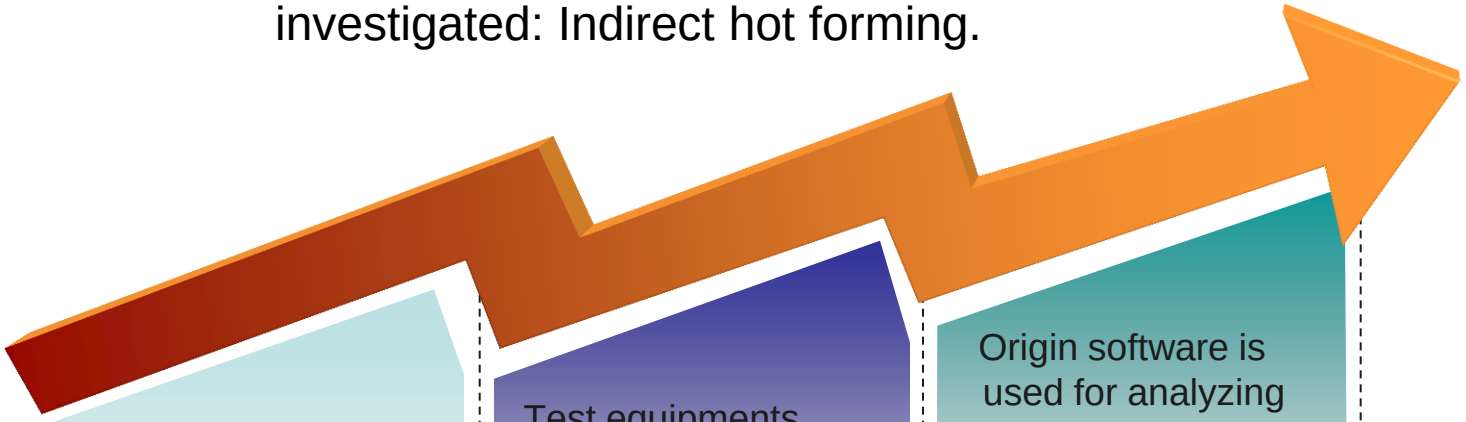
3.8 mm

C	Si	Mn	P	S	Al
	0.24	1.33	0.16	0.006	0.025
0.24	B	Cr	Ti	Ceq	Pcm
	0.004	0.18	0.025	0.508	0.344

Experimental Equipment



Hot stamping processes of rear axle beam using 22MnB5 with 3.8mm thickness were investigated: Indirect hot forming.



Different Process
- Different heating temperature
920、880、860℃
- Different soaking time
5min、3min、1min

Test equipments
- Nikon LV150 microscope

- MH-3 type hardness tester

- Tensile CMT-5305

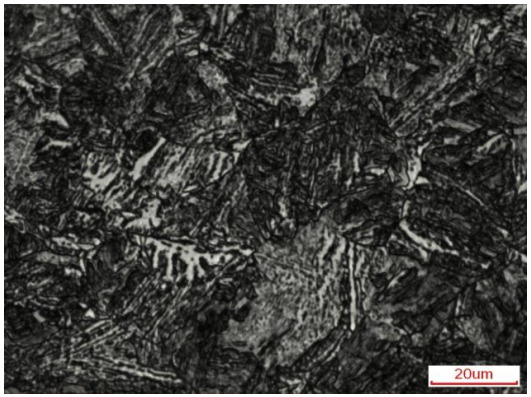
Origin software is used for analyzing the experimental data.

The microstructure and mechanical properties of different position of the samples are compared to draw a conclusion..

Microstructure under different Heating temperature

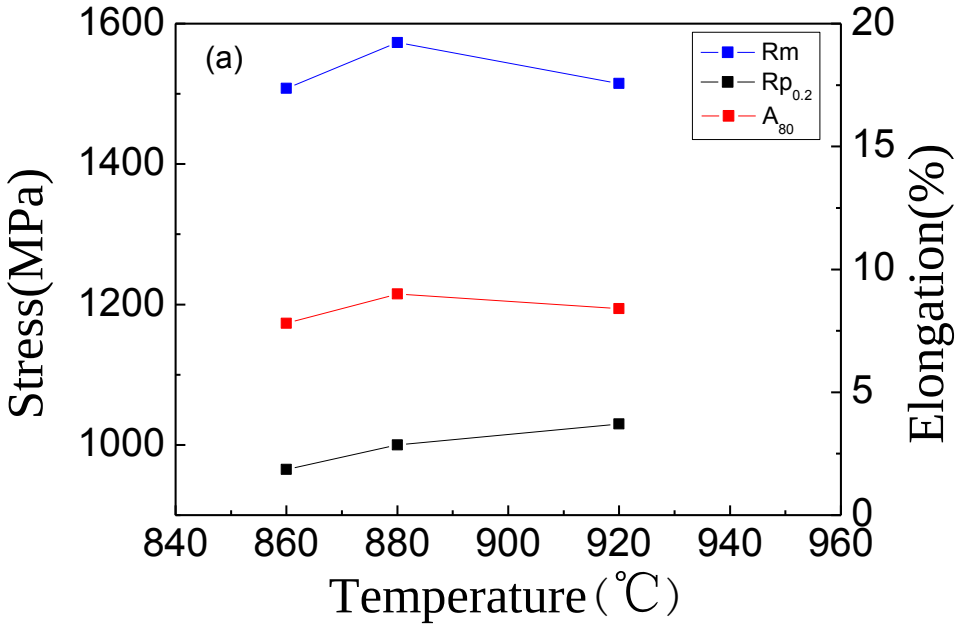
920℃

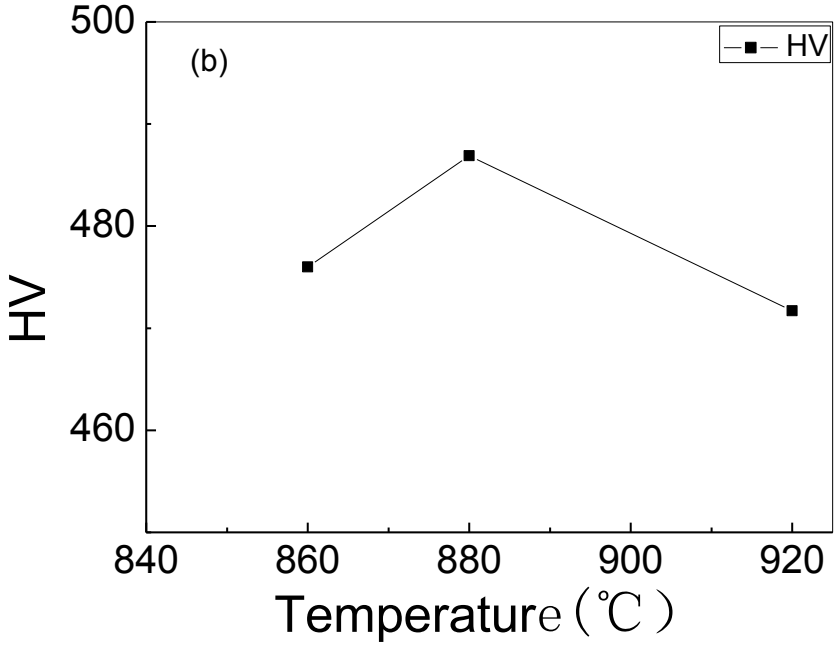
880℃



860℃

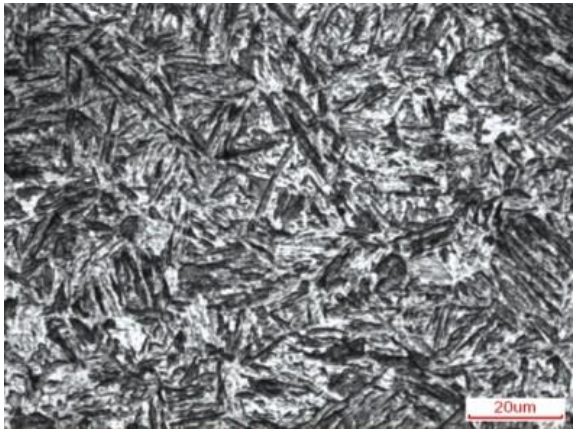
Mechanical Properties under different Heating temperature



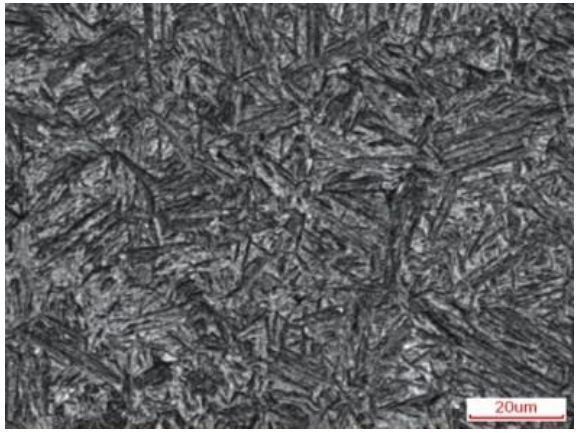


Heating temperature **880℃**

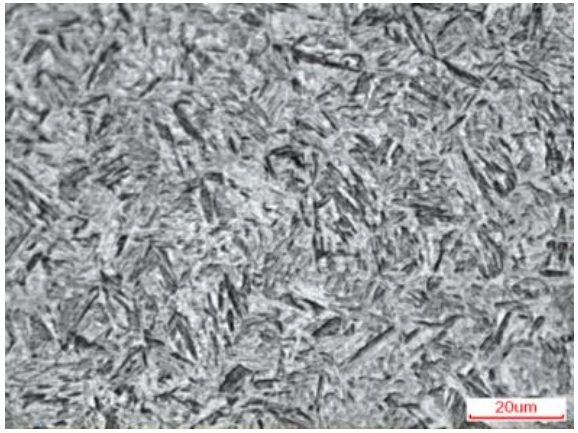
Microstructure under different Soaking time



880℃-5min

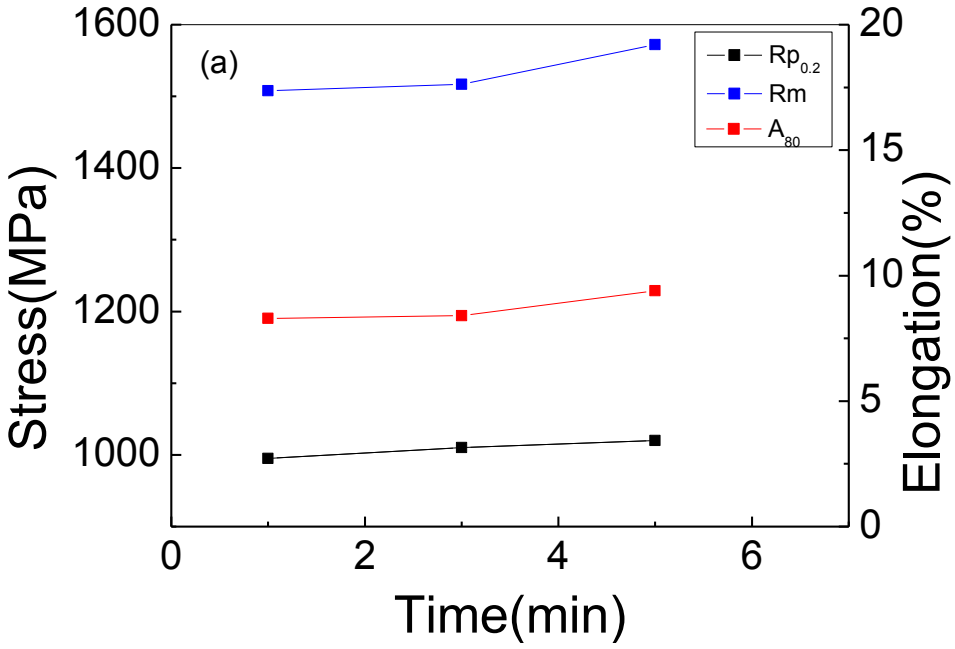


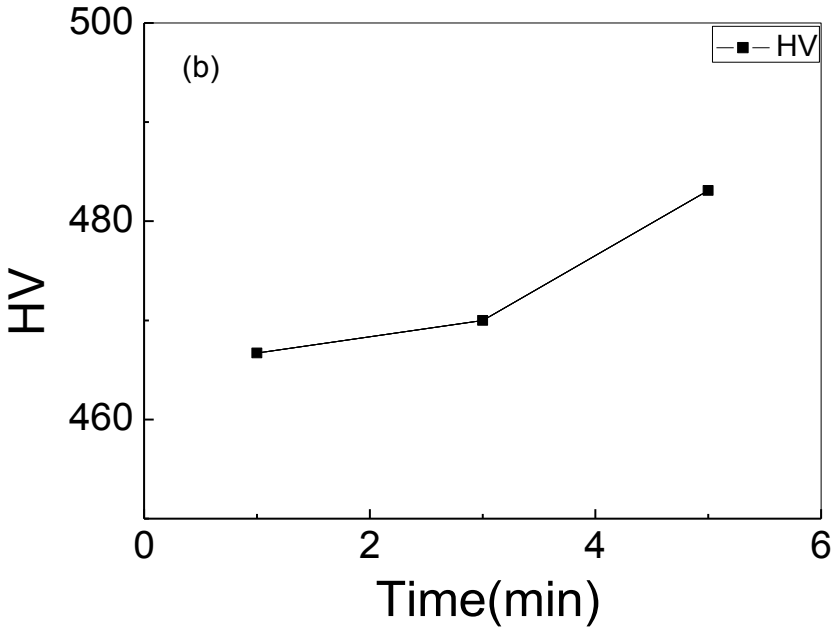
880℃-3min



880℃-1min

Mechanical Properties under different Soaking time





soaking time 5min

Conclusions

1. 860℃ heating temperature process can meet the needs of the production, TS reached more than 1500MPa, YS reached about 1200MPa, elongation reached more than 8% and microhardness reached more than 450HV

2. 880° C is the best process to this steel, the austenite grain grows with the increase of heating temperature, which influence the strength and ductility due to the coarse martensite. Also the austenitizing insufficiency will decreased the strength, too.

3. The holding time effect the uniformity and size of the lath martensite by influence the uniformity and grain size of austenite. To obtain a good strength-ductility combination, the holding time shouldn't be less than 5 min.

THANK YOU !

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