RIKOR-5 Application

Determining residual stresses in rolled steel samples, grain size being 0.1...0.4 mm approximately

Check was done at the IRO premises with participation of Dr. Eng. Sc. D.B. Matveev, Dr. Eng. Sc. A.V. Kotelkin, Dr. Phys.Math. Sc. A.D. Zvonkov, A.V. Lyuttsau

Object of check –was three rolled flat (with a bent in z- direction) samples after water quenching from 1250°C, the mean grain size being: 0.4 mm in the direction of rolling; 0.1 mm in transversal direction. Sample characteristics are given in table 1.

Table 1. **Characteristics of Samples**

Sample No.	1	2	3
Steel	X30K15M3	X30K15M3	X28K12M5T
Strain Level, %	70	80	70
Thickness, mm	0.65	0.45	0.45

Purpose of check – was to determine residual stresses in rolled steel samples with grain size of the order of 0.15 mm (across rolling) and 0.40 mm (along rolling).
The stress analysis technique used – was the «$Sin^2\psi$» method.
The radiation used – was CrKα..
The equipment used – was portable x-ray diffractometer «RIKOR-5».
Checkpoints – were points 1, 2, and 3 on the convex and concave sample surfaces.
Stress condition index – in each checkpoint, residual stress was determined in the direction of rolling (x) and in transversal direction (y).

Scheme of Measurements

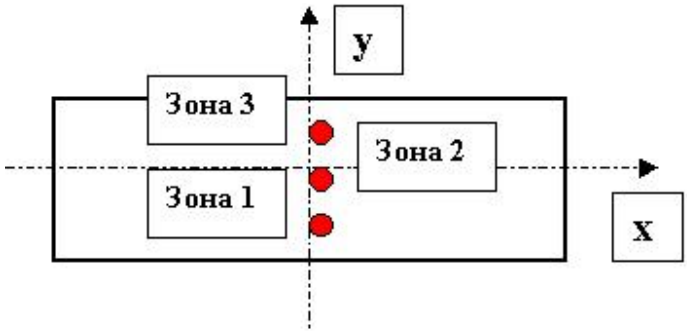


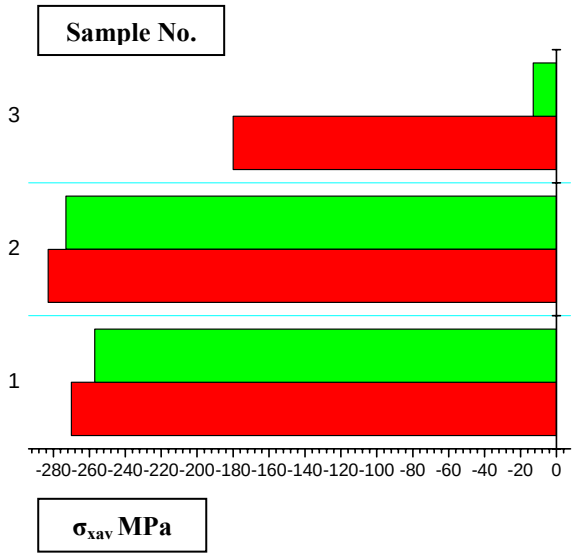
Fig. 1

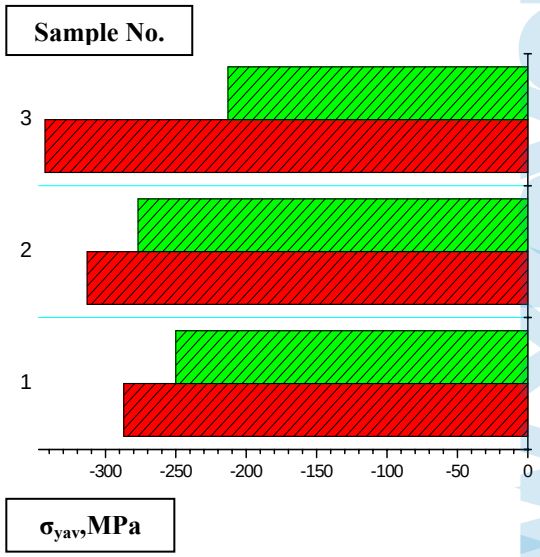
Results Obtained

Residual stresses identified for the samples are given in table 2. Graphically the results are shown in fig. 2 and 3.

Table 2. **Residual Stresses in Samples**

Sheet Surface	Pojnt No.	Sampel No.					
		1		2		3	
		σ_x,MPa	σ_y,MPa	σ_x,MPa	σ_y,MPa	σ_x,MPa	σ_y,MPa
convex	1	-200	-350	-320	-360	-210	-400
	2	-270	-210	-320	-430	-130	-400
	3	-340	-300	-210	-150	-200	-230
	σ_{av},Mpa	-270	-287	-283	-313	-180	-343
	CO,MPa	70	71	64	145	44	98
concave	1	-130	-160	-340	-240	-140	+15
	2	-370	-400	-180	-320	+140	-415
	3	-270	-190	-300	-270	-40	-240
	σ_{av},MPa	-257	-250	-273	-277	-13	-213
	CO,MPa	120	131	83	40	141	216





It follows from the data obtained that

- In all samples, in different directions, on different surfaces, compression stresses are observed;
- In all samples, along rolling, larger compressive stresses are observed versus across rolling;
- For the sample made of steel X28K12M5T, compression stresses in the direction of rolling are lower than for samples made of steel X30K15M3;
- Percent reduction increase from 70 to 80% does not affect the residual stress value.