INFLUENCE OF GAMMA IRRADIATION TO LIFETIME OF THE CHARGE CARRIERS IN SILICON DOPED BY NICKEL

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For study of influence γ - irradiation on the life time of the volatile carriers of charge (τ) in doped and control samples silicon with p-type conductivity which received by Chohralskiy method was used as initial material. Density of dislocation is ~ 10^4 cm^{-2}. Doping of silicon by nickel was carried out in the range of diffusion temperatures (T_{dif}) 1075÷1285°C with the subsequent slow (40°C/min) and fast (250°C/min) cooling.The radiation treatment of silicon samples was carried out by γ-quantum ^{60}Co with radiation power 750 R/s in the interval of fluences 10^{16}÷10^{18} cm^{-2}. The parameters of doped and control p-type silicon before and after irradiations are given in the table.

Sample type	ρ, Ohm·cm	T_{dif}, °C	Rate of cooling, °C/min	N_{Ni}, cm^{-3}		τ_o, s	K_τ, $cm^2 \cdot s^{-1}$
				$N_{irrad.}$	$N_{el.act.}$		
p-Si<B>	10,2	1075	250	$3 \cdot 10^{17}$	$1 \cdot 10^{13}$	$6 \cdot 10^{-7}$	$4,5 \cdot 10^{-12}$
p-Si<B>	10		40			$4,8 \cdot 10^{-7}$	$9,5 \cdot 10^{-12}$
p-Si<Ni>	9,7		250			$1,2 \cdot 10^{-6}$	$1,4 \cdot 10^{-12}$
p-Si<Ni>	9,6		40		$\leq 10^{12}$	$1 \cdot 10^{-6}$	$2,8 \cdot 10^{-12}$
p-Si<B>	12	1175	250	$7 \cdot 10^{17}$	$4 \cdot 10^{13}$	$8,4 \cdot 10^{-7}$	$3,9 \cdot 10^{-12}$
p-Si<B>	10		40			$4,8 \cdot 10^{-7}$	$9,1 \cdot 10^{-12}$
p-Si<Ni>	9,1		250			$1,7 \cdot 10^{-6}$	$1,2 \cdot 10^{-12}$
p-Si<Ni>	8		40		$\leq 10^{12}$	$1,05 \cdot 10^{-6}$	$1,9 \cdot 10^{-12}$
p-Si<B>	10,7	1275	250	$1 \cdot 10^{18}$	$7 \cdot 10^{13}$	$1,6 \cdot 10^{-6}$	$3,1 \cdot 10^{-12}$
p-Si<B>	11		40			$9,7 \cdot 10^{-7}$	$4,5 \cdot 10^{-12}$
p-Si<Ni>	9,8		250			$6,9 \cdot 10^{-6}$	$2,9 \cdot 10^{-13}$
p-Si<Ni>	9,6		40		$\leq 10^{12}$	$5,8 \cdot 10^{-6}$	$3,3 \cdot 10^{-13}$
p-Si<P,Ni>	67	1285	250	$1,4 \cdot 10^{18}$	$4 \cdot 10^{14}$	$1,8 \cdot 10^{-5}$	$1,5 \cdot 10^{-13}$
p-Si<P,Ni>	35		40		$6 \cdot 10^{14}$	$7 \cdot 10^{-6}$	$2,7 \cdot 10^{-13}$

The obtained results make it possible to give the following conclusions:

It is installed that with growing of the concentration of nickel atoms (N_{Ni}) in p-type silicon value of τ_o grows independent from velocity post-diffusion cooling in contrast with control silicon sample.

It is shown that with growing of concentration of the nickel atoms the factor radiation change of live time of carriers of the charge (K_τ) falls in silicon doped in 3÷10 times, compared with control silicon.

It is proposed the mechanism which explains an increase and the stabilization of the life time of charge carriers into p-Si<Ni> caused by reduction in the concentration of thermo- and radiation defects and by formation of microheterogeneity in the silicon doping process by the nickel impurities.

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