Structural Anisotropy of MBE-grown CdTe/SnTe/CdTe//GaAs(001) Films

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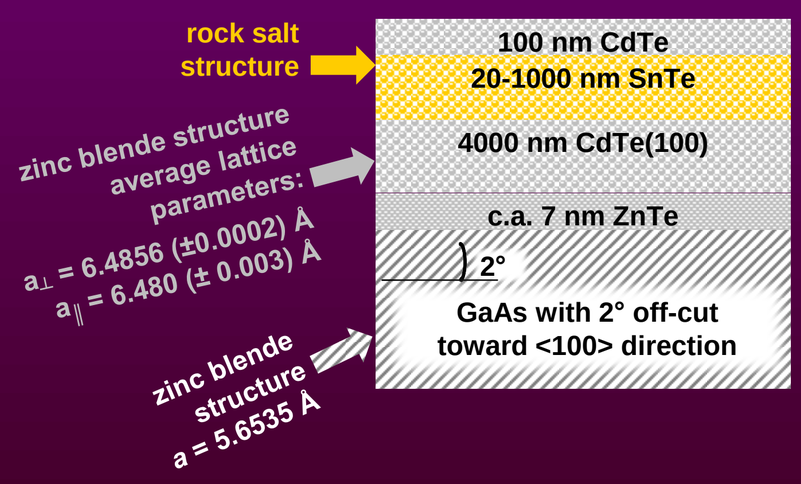
Introduction

SnTe belongs to the topological crystalline insulators, which are interesting materials, important especially from the point of view electronics and spintronics development.

The aim of our work was SnTe samples crystallographic properties and surface nanoripples morphology investigation. As the experimental techniques high-resolution X-ray diffraction and atomic force microscopy were used.



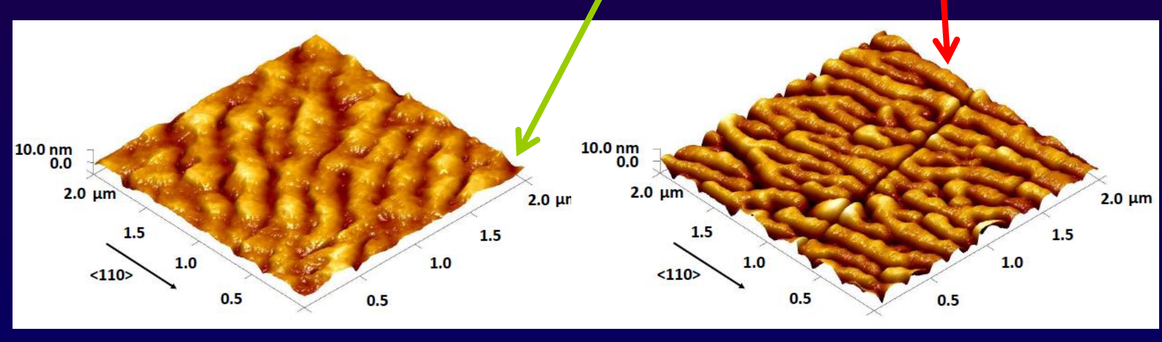
High-Resolution X-ray Diffraction Results

Sample's number	GaAs off-cut [deg]	Lattice misorientation to GaAs [deg]	Δ Phi to GaAs [deg]	Lattice vertical strains $\varepsilon_\perp$ x10^4	Lattice relaxation [%]	Lattice misorientation to CdTe [deg]	Out-of-plane lattice parameter $a_\perp$ [Å] (±0.0002)	In-plane lattice parameter $a_\parallel$ [Å] (± 0.003)	Lattice vertical strains $\varepsilon_\perp$ x10^4	Lattice relaxation [%]
	GaAs		CdTe			SnTe				
134-15	1.94	0.55	16.37	8.3	99.2	0.01	6.3232	6.333	-10.2	93.5
135-15	1.97	0.50	14.41	3.9	99.6	0.08	6.3238	6.331	-7.5	96.5
136-15	1.98	0.67	19.20	2.5	99.8	0.06	6.3267	6.335	-8.6	96.9
137-15	2.03	0.68	17.89	3.2	99.7	0.14	6.3228	6.330	-7.5	96.9
138-15	2.00	0.69	19.68	4.6	99.6	0.10	6.3248	6.336	-11.7	95.1
139-15	2.00	0.62	17.33	3.1	99.7	0.12	6.3225	6.338	-16.1	94.9

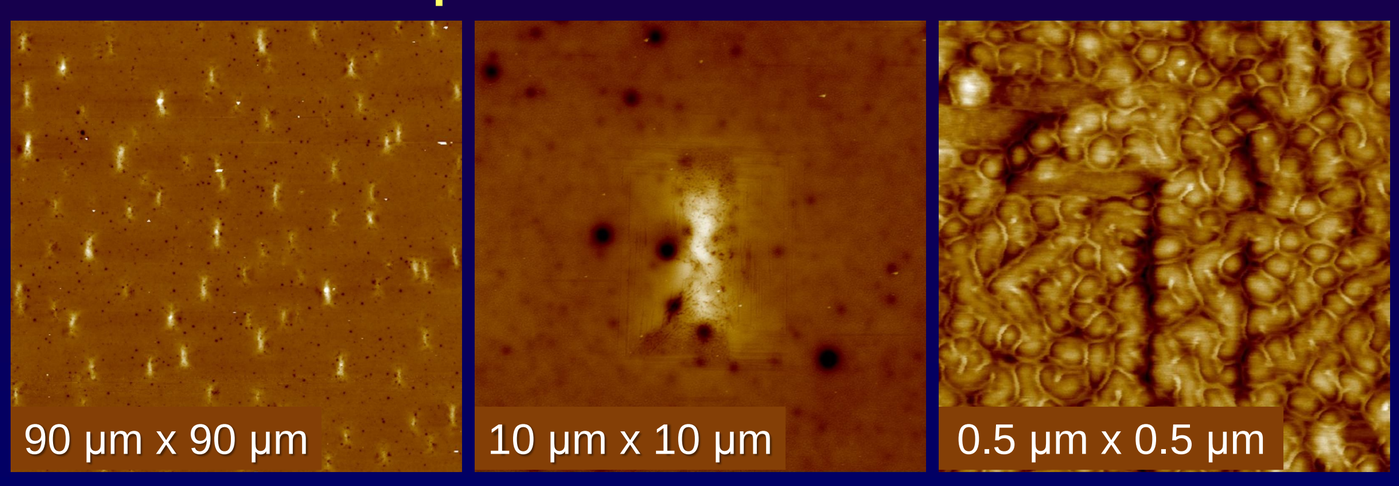
Atomic Force Microscopy Results

Growth Conditions

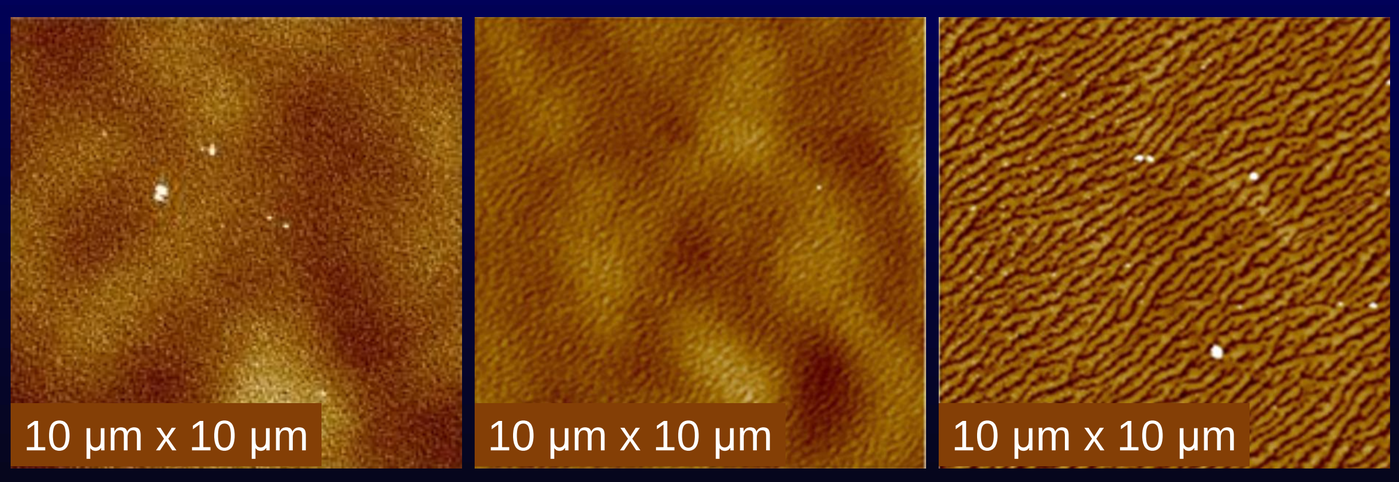
Sample's number	SnTe thickness [nm]	Substrate T [°C]	Te/SnTe molecular flux ratio	Nanoripples' orientation close to
138-15	1000	310	0,0000	<120>
139-15	1000	310	0,0051	<120>
136-15	1000	270	0,0089	<100>
137-15	1000	310	0,0093	<100>
135-15	1000	310	0,0135	<100>
133-15	80	310	0,0139	<100>
131-15	20	310	0,0148	absent
134-15	888	310	0,0156	<100>
Ref. sample	-	-	-	absent

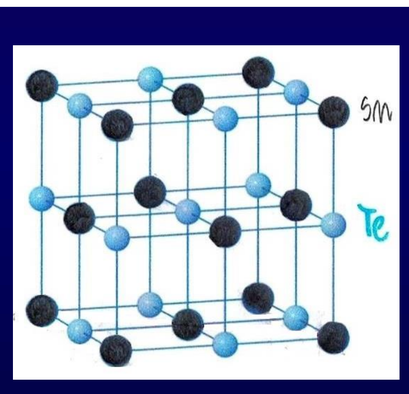


Reference sample - GaAs substrate with CdTe buffer:

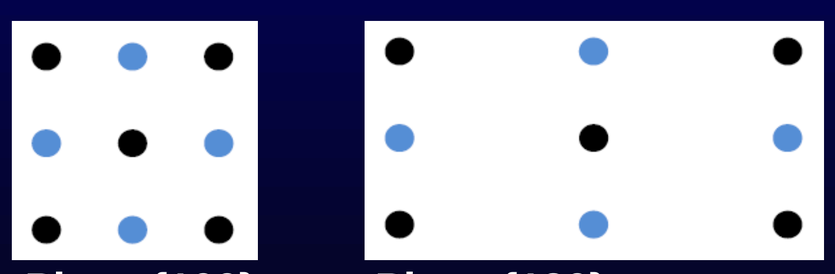


131-15 **20 nm SnTe:** 133-15 **80 nm SnTe:** 136-15 **1000 nm SnTe:**

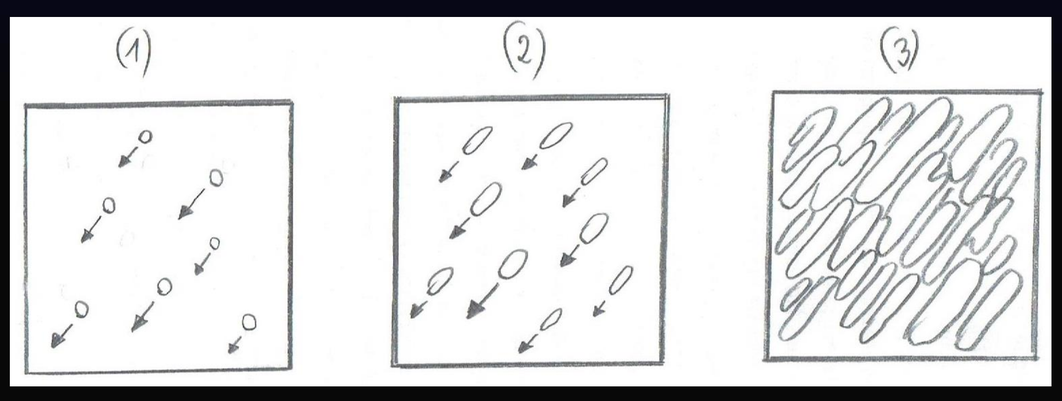




SnTe lattice structure



Plane {100} **Plane {120}**



Preferred SnTe growth order along <100>

Summary

- the samples' surface is shaped into nanoripples oriented close to <120> or <100> crystallographic directions,
- the differences between these directions was found to be related rather to Te/SnTe molecular flux ratio than to GaAs off-cut direction and the layers misorientation.

Acknowledgments:
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