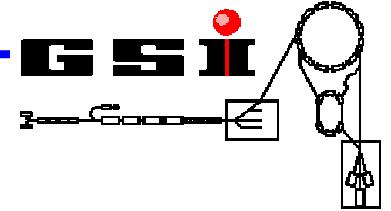
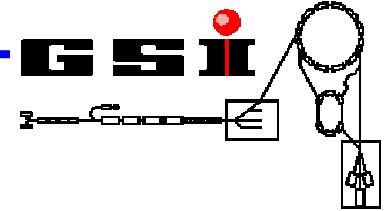


Metallization of Diamonds at the Target Laboratory at GSI

Willi Hartmann, Annett Hübner, Birgit Kindler,
Bettina Lommel, Jutta Steiner

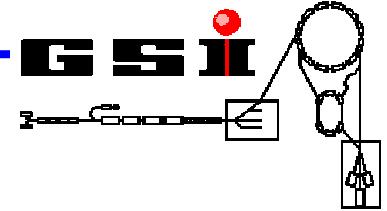


- Pretreatment
- Evaporation
 - Al
 - Cr / Au
 - Ti / Pt / Au
 - Annealing
 - Setup
- Sputtering
 - Al
 - Cr / Au
 - Ti / Pt / Au
 - Annealing
 - Setup
- Outlook



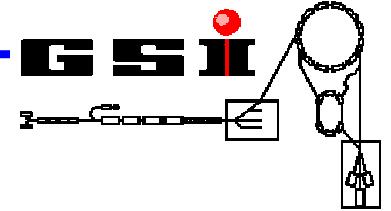
Pretreatment

- Cleaning at DL
- Kept under water-free and oxygen-free argon in glove box
- Glow discharge
 - Argon
 - Purity 99.996 %
 - $1 \cdot 10^{-2}$ mbar
 - 2 minutes
 - 2 kV



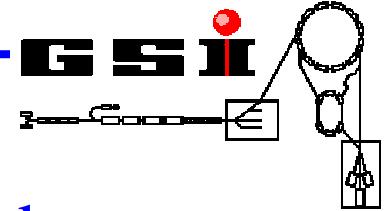
Evaporation of Aluminium

- Aluminium
 - Purity of the starting material 99.99 %
 - Thermal evaporation
 - Tungsten boat



Evaporation of Chromium / Gold

- Chromium
 - Water-cooled copper crucible
 - Electron-beam gun
 - Purity of the starting materials 99.6 %
- Gold
 - Tungsten boat
 - Thermal evaporation
 - Purity of the starting materials 99.99 %



Evaporation of Titanium / Platinum / Gold

- Titanium / Platinum

- Out of water-cooled copper crucible

- Electron-beam gun

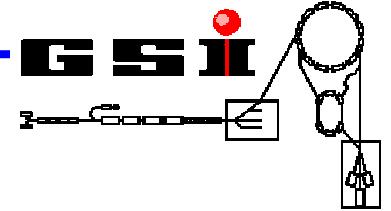
- Purity of the starting materials 99.99 %

- Gold

- Tungsten boat

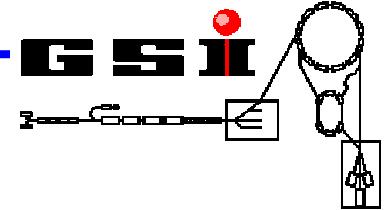
- Thermal evaporation

- Purity of the starting materials 99.99 %



Evaporation

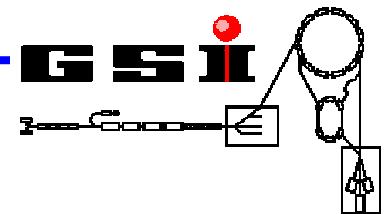
- Glow discharge only in combination with evaporation
- Back side covered
- Deposition of all layers on one side
- Cooling
- Opening recipient
- Turning diamond
- Covering back side, same procedure for the second side



Annealing

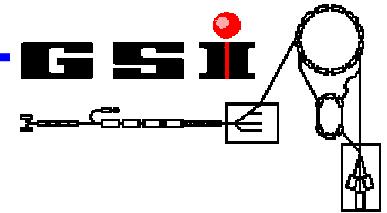
- 500°C
- 10 min
- Under argon
- Purity 99.9999 %
- Quartz boat in quartz tube
- Resistively heated furnace





31.08.2005

10

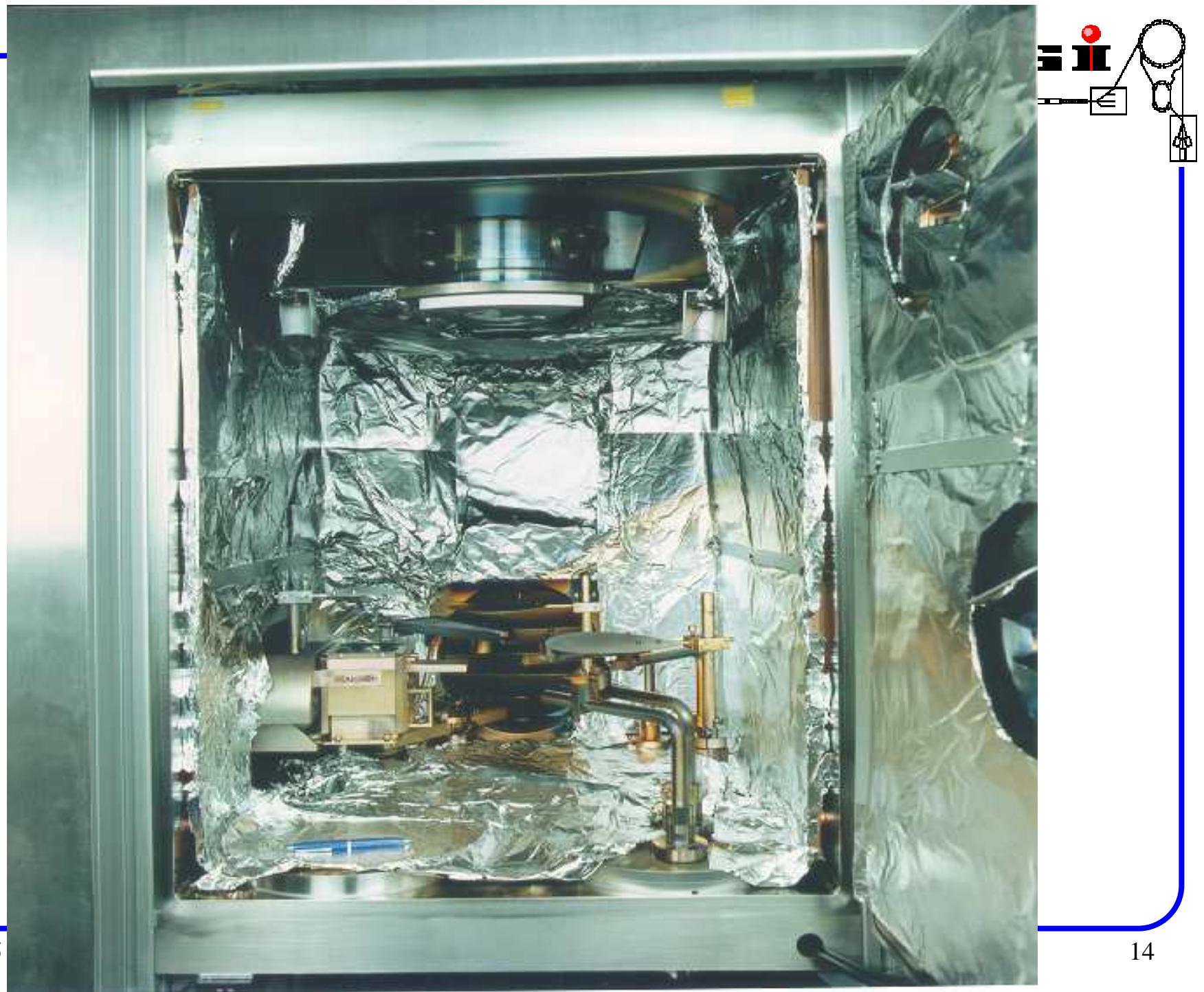


31.08.2005

11

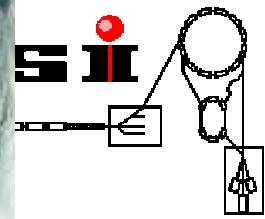






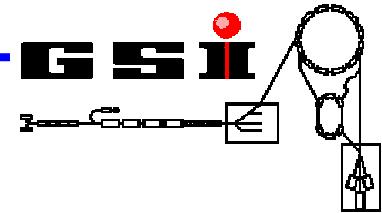
31.08.2005

14



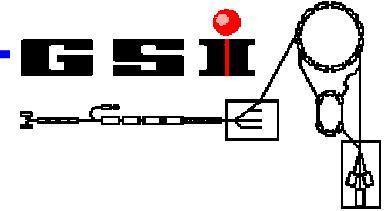
31.08.2005

15



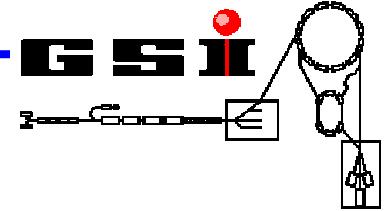
Evaporation – identical sides

Amount	Glow discharge	1. Layer	2. Layer	3. Layer	Annealed
2	X	Aluminium 100 nm			
4	X	Aluminium 600 nm			X
13	X	Chromium 50 nm	Gold 200 nm		
3	X	Chromium 50 nm	Gold 200 nm		X
4	X	Titanium 100 nm	Platinum 100 nm	Gold 3000 nm	X
2	X	Titanium 10 nm	Platinum 10 nm	Gold 300 nm	X



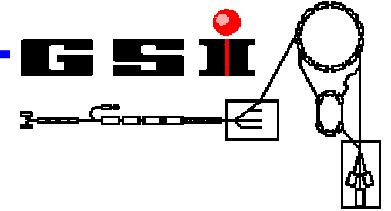
Evaporation – different sides

Amount	Glow discharge	1. Layer	2. Layer	3. Layer	Annealed
2	X X	Aluminium 500 nm Titanium 10 nm	Platinum 10 nm	Gold 300 nm	X



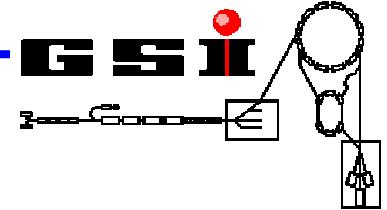
Magnetron Sputtering I

- No glow discharge applied
- Sputter gas: argon 99.9999 %
- 1" sputter sources
- 3 sputter sources available
- Power up to 500 W feasible
- Typically ~ 150 W
- setup turnable:
 - 1. layer on both sides
 - 2. layer on both sides
 - 3. layer on both sides



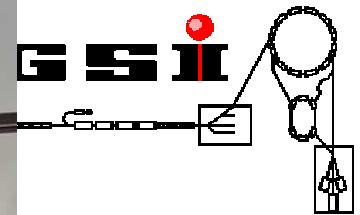
Magnetron Sputtering II

- Purity of sputter targets:
 - Aluminium: 99.999 %
 - Chromium: 99.99 %
 - Gold: 99.99 %
 - Platinum: 99.99 %
 - Titanium: 99.9 %



Annealing

- 500°C
- 10 min
- Under argon
- Purity 99.9999 %
- Quartz boat in quartz tube
- Resistively heated furnace



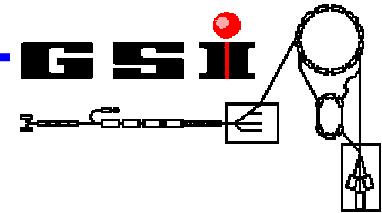
31.08.2005

21



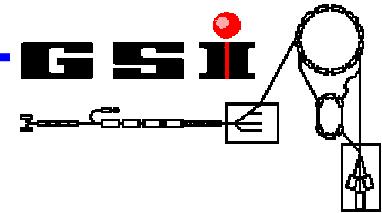
31.08.200

22



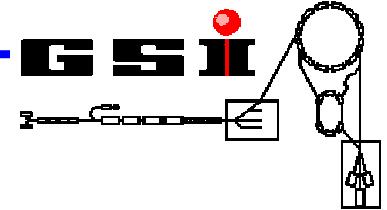
Sputtering – identical sides

Amount	Glow discharge	1. Layer	2. Layer	3. Layer	Annealed
3		Aluminium 100 nm			
10		Chromium 50 nm	Gold 100 nm		
7		Chromium 50 nm	Gold 100 nm		X
6		Chromium 50 nm	Gold 200 nm		
2		Chromium 500 nm	Gold 100 nm		X
6		Titanium 20 nm	Platinum 30 nm	Gold 100 nm	X



Sputtering – different sides

Amount	Glow discharge	1. Layer	2. Layer	3. Layer	Annealed
1		Chromium 500 nm Titanium 20 nm	Gold 100 nm Platinum 40 nm	Gold 100 nm	X
1		Chromium 50 nm Titanium 20 nm	Gold 100 nm Platinum 30 nm	Gold 100 nm	X



Outlook

- Little more statistics
- Dedicated sputtering setup ordered
- Oil-free pumping
- DC sputtering
- 3 1 " sputter sources
- tilted sputter head
- Glow discharge