



超高真空技術による室温接合と磁性薄膜開発

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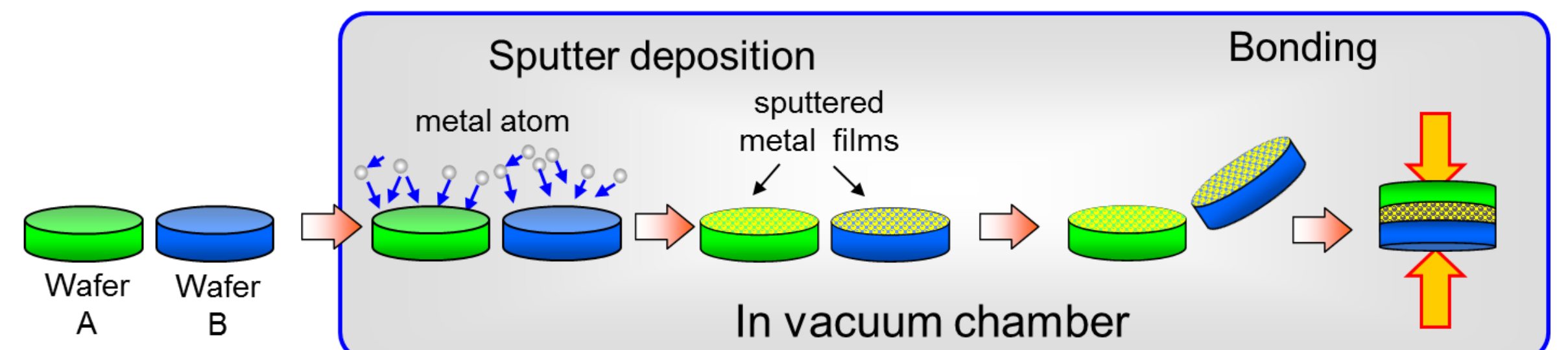


1. 新しい室温接合技術(原子拡散接合法, Atomic Diffusion Bonding)

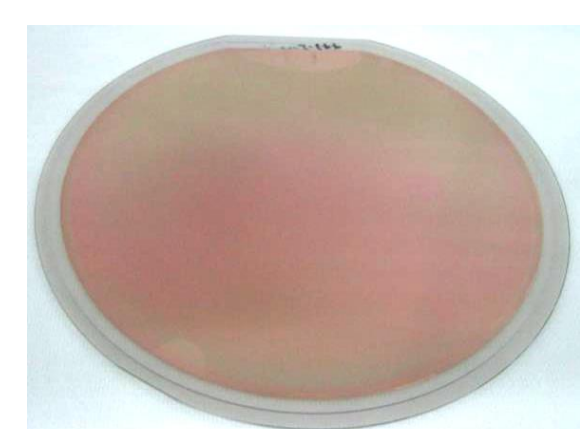
【ADBの利点】

- ◆ 鏡面研磨したあらゆる材質が接合できる
- ◆ Wを含む全金属を用いて接合できる
- ◆ 0.2 nmの金属膜厚でも接合できる

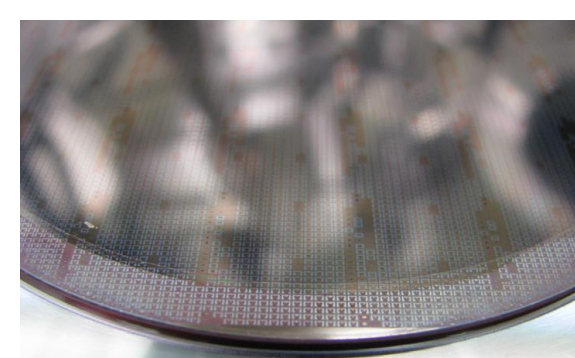
T. Shimatsu, R. H. Mollema, D. Monsma, E. G. Keim and J. C. Lodder, *J. Vac. Sci. Technol.*, A 16, 2125 (1998).
T. Shimatsu and M. Uomoto, *J. Vac. Sci. Technol.*, B 28, 706 (2010), *ECS Transactions*, 33(4), 61 (2010).
T. Shimatsu, M. Uomoto and H. Kon, *ECS Transactions*, 64 (5) (2014) 317.



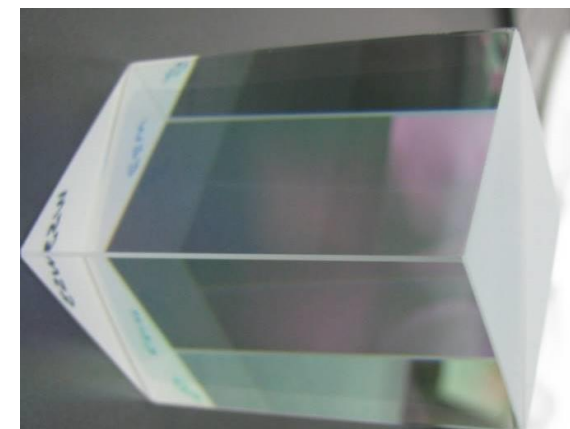
【ADBの応用例】



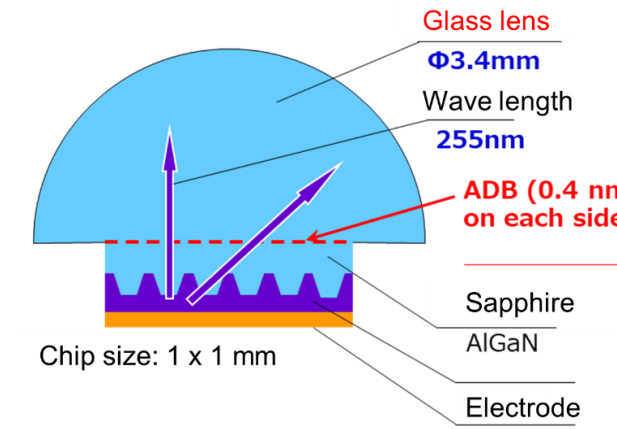
Piezoelectric wafers bonded using very thin films



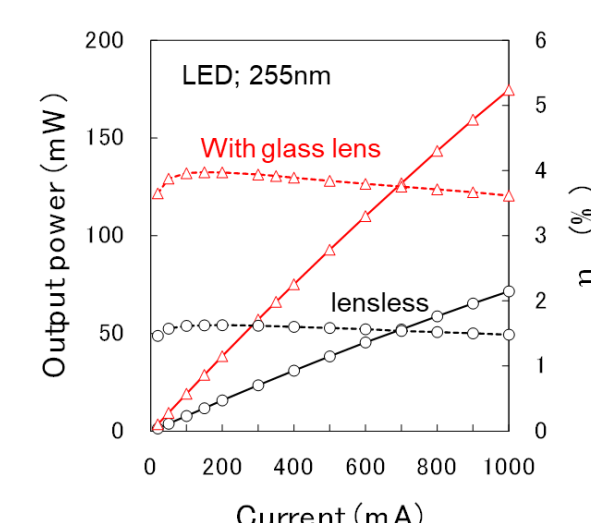
TEG-wafer surface before bonding



Polarized Beam Splitters (PBS) prism body (100% transmittance at bonded interface)



DUV-LDEs bonded with glass lenses



The highest external quantum efficiency values yet achieved



Bonding with no clear damage to the InGaAs wafer surface

高性能SAWフィルター

T. Takai, Y. Takamine, H. Iwamoto, M. Koshino, T. Wada, M. Hiramoto, WE2C-2, IMS2016, San Francisco, May 25 (2016).



高輝度光学部品

G. Yonezawa, Y. Takahashi, Y. Sato, S. Abe, M. Uomoto, and T. Shimatsu, *ECS Transactions*, 86 (5), 233-245 (2018).



高出力深紫外LED

M. Ichikawa, A. Fujioka, T. Kosugi, S. Endo, H. Sagawa, H. Tamaki, T. Mukai, M. Uomoto, and T. Shimatsu, *Applied Physics Express* 9, 072101 (2016)



同種・異種半導体の接合

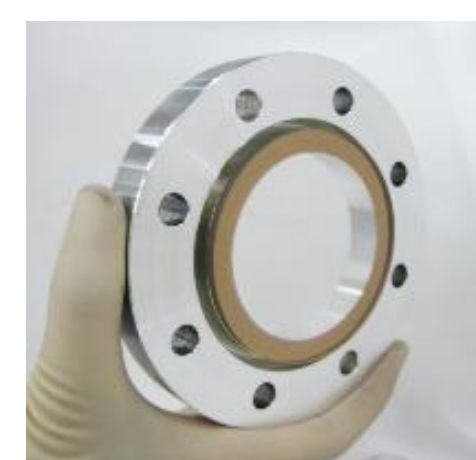
M. Uomoto, Y. Yamada, T. Hoshi, M. Nada, and T. Shimatsu, *JJAP*, 57, 02BA03 (2017).



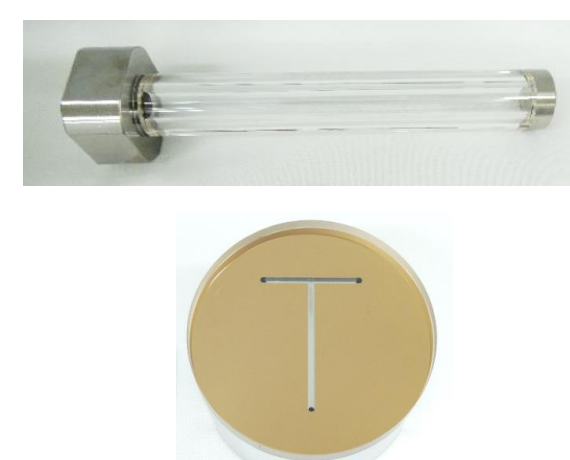
TEM cross section images of Si wafers bonded using Nb films

超電導デバイス用Nb接合

M. Uomoto, and T. Shimatsu, *JJAP Special Issue: Low Temperature Bonding for 3D Integration* (accepted, JJAP-S1101174.R1)



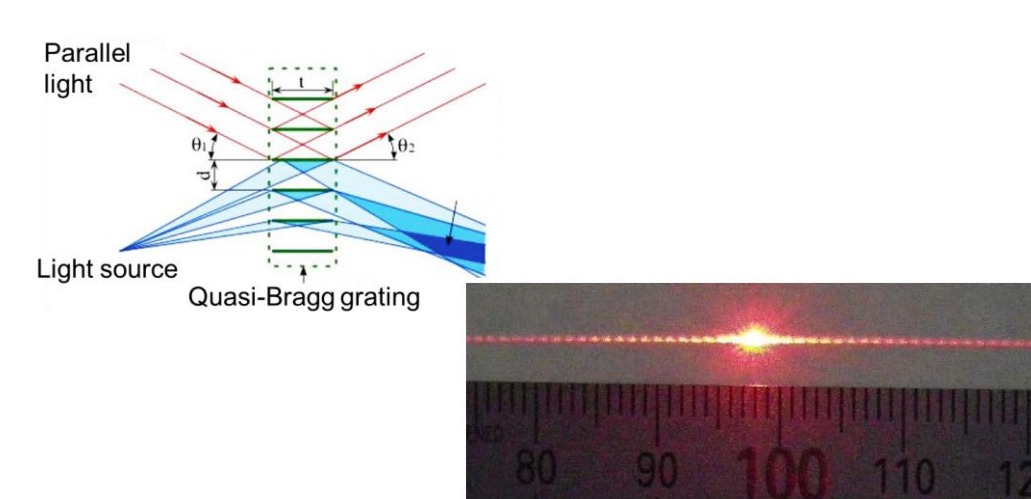
UHV viewing port of Al bonded with Sapphire



High pressure tube and Liquid flow reactor

金属/セラミクス精密部品

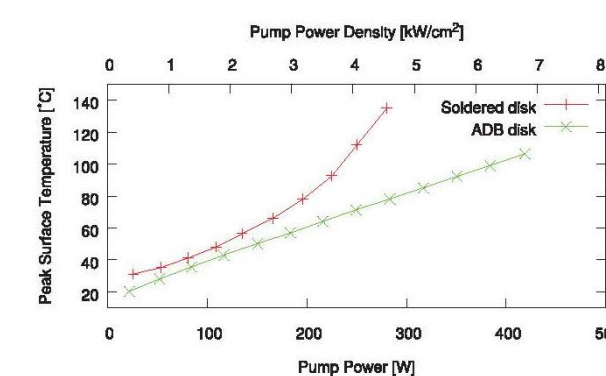
T. Shimatsu, M. Uomoto, *CERAMICS JAPAN*, vol. 51, no.2, 91-93 (2016).



Quartz wafers were stack-bonded, and diced with 0.9 mm width.

天文用長波長回折格子

N. Ebizuka, T. Okamoto, M. Uomoto, T. Shimatsu, M. Sasaki, A. Bianco, C. Packham, and W. Aoki, 2017 Proc. of SPIE Vol. 10233 102330M, 2017



YAG disk bonded with heat sink for high cooling efficiency

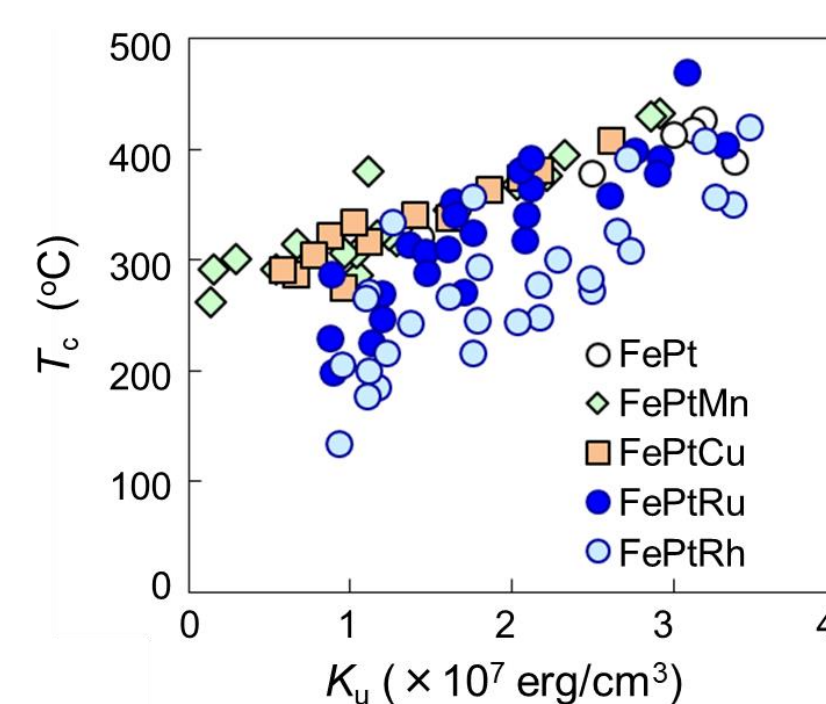
高放熱YAGレーザ

S. S. Nagisetty, P. Severova, T. Miura, M. Smrž, H. Kon, M. Uomoto, T. Shimatsu, M. Kawasaki, T. Higashiguchi, A. Endo and T. Moeck, *Laser Phys. Lett.*, 14, 015001 (2017).



2. 超高密度磁気記録用磁性薄膜の形成と物性

【熱アシスト記録HAMR用磁性膜】



$T_c \sim K_u$ for $L1_0$ -FePt-(Ru, Rh) films

FePt-(Rh, Ru) thin films with T_c values approximately 100 °C lower than that of the FePt thin film.

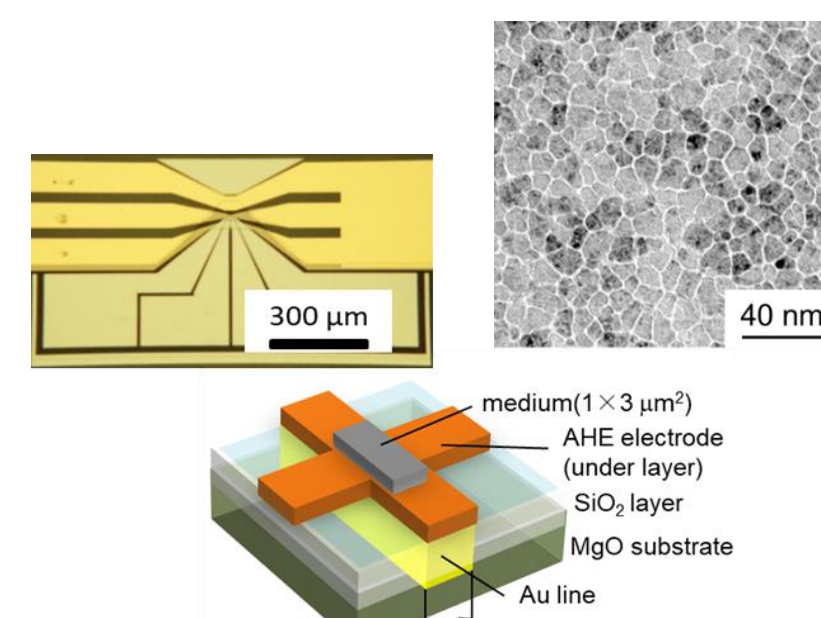
Additive, X	Fe (at.%)	Pt (at.%)	X (at.%)	M_s (emu/cm ³)	K_u (erg/cm ³)	T_c (°C)
Rh	55	45	5	1070	2.7	327
Ru	46	48	6	750	2.1	319
Cu	43	36	21	774	1.1	317
(None)	51	49	-	1024	3.2	427

$L1_0$ -FePt-(Ru, Rh) 規則合金材料の開発 (低キュリー温度 T_c と高磁気異方性 K_u の両立)

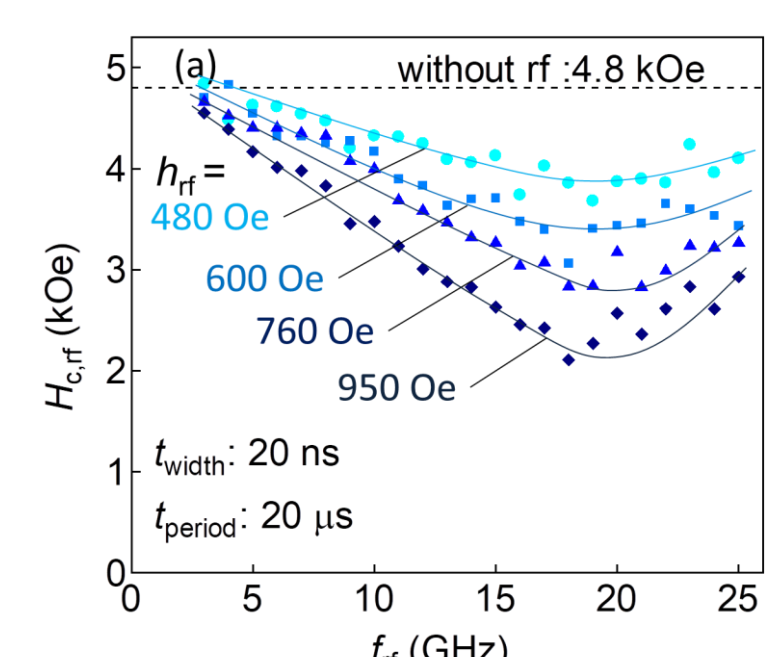
T. Shimatsu, T. ONO, T. Moriya, H. Nakata, K. Komiyama, S. Uchida, H. Oyama, H. Kikuchi, H. Kataoka, K. Sato, A. Furuta, T. Yoshizawa, M. Hatayama, K. Tsumura, N. Kikuchi, and O. Kitakami, The 28th Magnetic Recording Conference 2017, A-1, (2017) A-1.
T. Ono, N. Kikuchi, S. Okamoto, O. Kitakami and T. Shimatsu, *Applied Physics Express*, 11, 033002(1-3) (2018)



【マイクロ波アシスト記録MAMR】



Schematic illustration of fabricated sample structure



Significant reduction of microwave-assisted switching field

マイクロ波アシスト・スイッチング機構の解明 (CoCrPt-TiO₂ グラニューラ記録媒体)

K. Shimada, T. Shimatsu, N. Kikuchi, S. Okamoto, and O. Kitakami, *Magnetics and Optics Research International Symposium (MORIS 2018)*, Tu-P-01, New York (2018).
N. Kikuchi, K. Shimada, T. Shimatsu, S. Okamoto, and O. Kitakami, *Japanese Journal of Applied Physics*, 57, 09TE02(1-4) (2018)

