

# Co-based magnetic alloy for high TMR element

TMR ratio over 200% with no B addition, low temperature heat treatment and sputtered film formation

## Overview

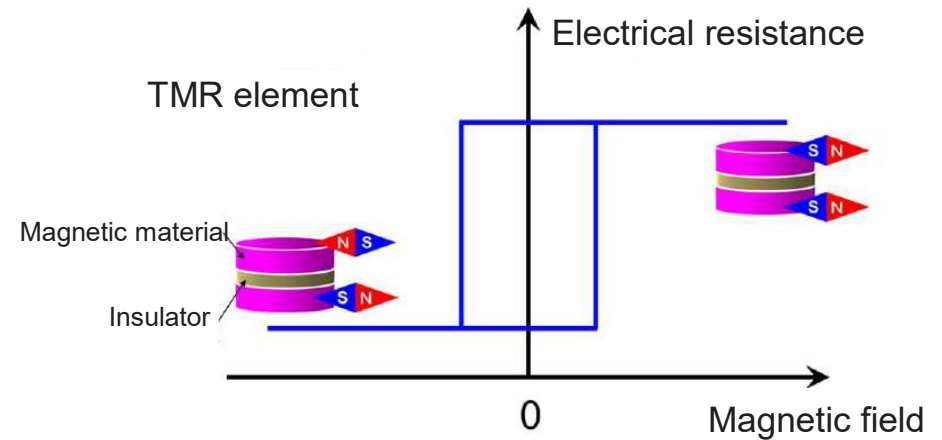
TMR element showing the tunnel magnetoresistance (TMR) effect, has been applied to products such as magnetic sensor, non-volatile memory, etc. The TMR ratio, which represents the variation ratio of element resistance, is one of the element performance indicator and it is an important characteristic that influences the specification of the applied product. TMR element using amorphous FeCoB magnetic alloy and MgO tunnel barrier is currently the main material and can be fabricated by sputtering method which is suitable for mass production. This is an excellent material which becomes FeCo/MgO crystal when B is diffused by heat-treating the element and shows 200-600% TMR ratio. However, heat treatment with B diffusion could be a factor in reducing the functionality of other layers adjacent to FeCo. This invention provides a technology for Co-based magnetic irregular alloy showing TMR ratio comparable to FeCoB by low temperature heat treatment, even without the addition of B.

## Product Application

- ❑ Products using magnetoresistive element in general
- ❑ Magnetoresistive memory (MRAM, etc.)

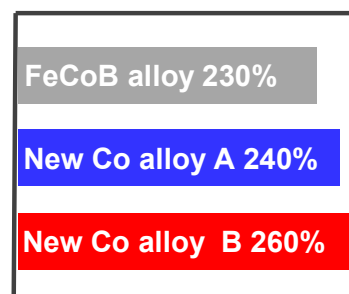
## IP Data

IP No. : WO2020/246553  
 Inventor : MIZUKAMI Shigemi, TSUCHIYA Tomoki, ICHINOSE Tomohiro, KUNIMATSU Kazuma  
 Admin No. : T19-018



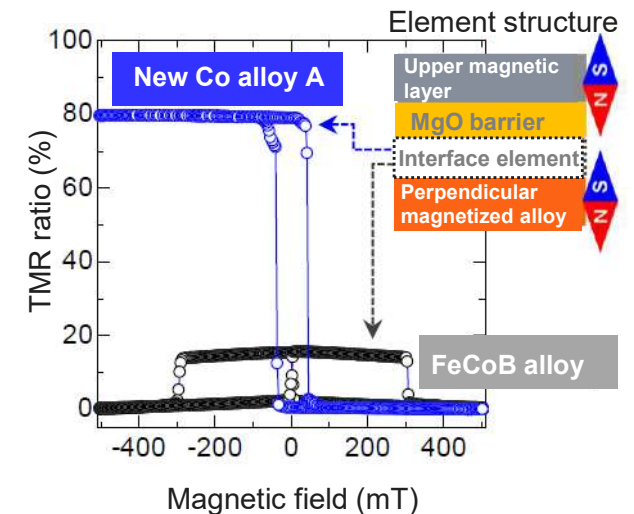
## TMR ratio over 200% without B addition

Element characteristics (TMR ratio) (%)



Note)  
 At 350°C heat treatment  
 Data comparison in our laboratory

Example of TMR element application in combination with perpendicular magnetized magnetic material



## Related Works

- [1] Kunimatsu et al., Appl. Phys. Express 13, 083007 (2020).
- [2] Suzuki et al., Appl. Phys. Lett. 118, 172412 (2021).

## Contact