KLY5 / MFK2 Comparison

How to select a Kappabridge

Introduction

AGICO is a worldwide renowned manufacturer of the laboratory instruments for measurements of magnetic susceptibility of rocks and environmental samples. For several decades, its induction-based Kappabridges have facilitated measurements of magnetic susceptibility (and its variations with field and frequency) and anisotropy of magnetic susceptibility (AMS) with outstanding sensitivity and user comfort. Additionally, with optional temperature control units, measurements of temperature variation of magnetic susceptibility can be performed.

Currently, two model lines are available, KLY5 series and MFK2 series, both featuring the latest state-of-the-art technology but having slightly different measuring possibilities. This document describes both instruments in detail, points out to their major differences (highlighted in red throughout the document), and shows their slightly different applications.

Both model lines of Kappabridges are produced in automatic (KLY5-A, MFK2-FA) and non-automatic (KLY5-B, MFK2-FB) versions. The automatic versions are equipped with the Up/Down Mechanism and the specimen Rotator. This configuration enables the full range of measurements including the temperature variation of magnetic susceptibility and automatic AMS. The non-automatic Kappabridges are the cost-driven basic versions intended for the manual measurements of magnetic susceptibility and manual AMS using the 15-directions design, only. Please note that the non-automatic versions can be upgraded to the respective automatic versions but such an upgrade can be performed only at the AGICO facility in Brno, Czech Republic.

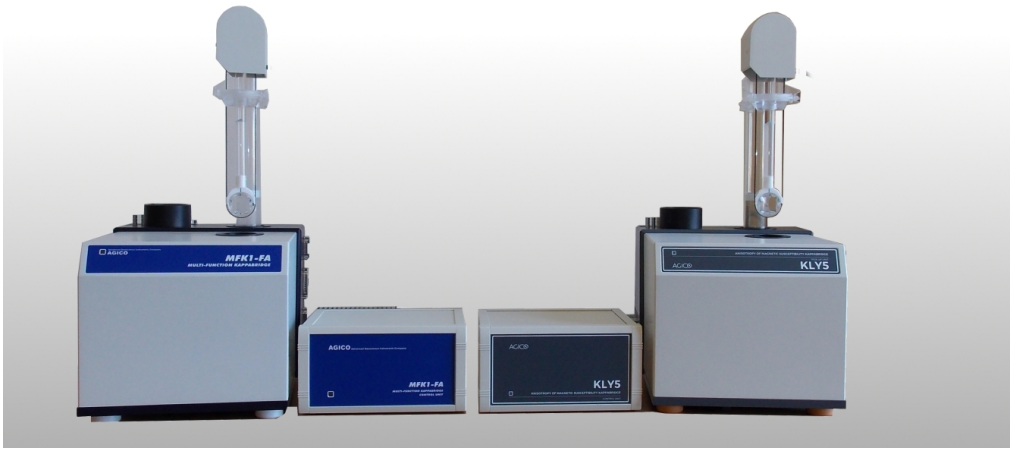

Figure 1: MFK2-FA and KLY5-A Kappabridges

KLY5

The KLY5 is single frequency Kappabridge designed for measurement of magnetic susceptibility and its anisotropy in weak variable magnetic fields (field range from 5 A/m to 750 A/m). KLY5 brings precise measurement of both in-phase and out-of phase components of magnetic susceptibility and AMS.

Main features

- High sensitivity 2×10^{-8} SI
- Measurement of in-phase and out-of-phase susceptibility
- High precision of phase angle[1] determination 0.1 °
- AMS of in-phase and out-of phase susceptibility
- Automated measurement in variable fields (KLY5-A)
- Built-in circuitry for controlling optional CS4 and CS-L instruments (KLY5-A)
- Supports 3D rotator (KLY5-A)

Technical specifications

Operating frequency	1 220 Hz
Field intensity range	5 – 750 A/m
Field homogeneity	0.2 %
Measuring range	up to 0.5 SI at 750 A/m
	up to 1 SI at 400 A/m
Accuracy within one range	±0.1 %
Accuracy of absolute calibration	±3 %
Pick-up coil inner diameter	43 mm

[1] Phase angle is defined as: phase $=$ atan($\varkappa_{\text{out}}/\varkappa_{\text{in}}$), where $\varkappa_{out}$ is out-of-phase component of magnetic susceptibility and $\varkappa_{in}$ is in-phase component of magnetic susceptibility

MFK2

MFK2 is a three frequency Kappabridge for measurement of magnetic susceptibility and its anisotropy in weak variable magnetic fields (field range from 5 A/m to 700 A/m) . Besides the in-phase magnetic susceptibility, relative changes[2] of the out-of phase magnetic susceptibility can be measured. The MFK2-FA and MFK2-FB models are capable of operating, besides at the basic frequency of 976 Hz, also at two additional frequencies of 3 904 Hz and 15 616 Hz.

Main features

- High sensitivity 2×10^{-8} SI
- Three operating frequencies (976 Hz, 3 904 Hz and 15 616 Hz)
- Measurement of in-phase and relative changes of out-of-phase susceptibility
- AMS of in-phase susceptibility only
- Automated measurement in variable fields (MFK2-FA)
- Built-in circuitry for controlling optional CS4 and CS-L instruments (MFK2-FA)
- Supports 3D rotator (MFK2-FA)

Technical specifications

Operating frequencies	976 Hz (F1)
	3 904 Hz (F2)
	15 616 Hz (F3)
Field intensity ranges	5 – 700 A/m (F1)
	5 – 350 A/m (F2)
	5 – 200 A/m (F3)
Sensitivities	F1 – 2×10^{-8} SI
	F2 – 6×10^{-8} SI
	F3 – 12×10^{-8} SI
Field homogeneity	0.5 % (F1)
Measuring range	up to 0.5 SI at 700 A/m (F1)
Accuracy within one range	±0.1 %
Accuracy of absolute calibration	±3 %
Pick-up coil inner diameter	43 mm

[2]The measured value of out-of-phase susceptibility is considered as relative because it depends on the magnitude of magnetic susceptibility and it also may vary with time.

Comparison of Kappabridges

Major difference is presence of three operating frequencies (MFK2) or precise measurement of out-of-phase susceptibility (KLY5). Table 1 summarizes measurable properties of both models.

Instrument	**KLY5-A**	**MFK2-FA**
Magnetic susceptibility (in-phase)	yes	yes
Magnetic susceptibility (out-of-phase)	yes	relative changes only
AMS (in-phase)	yes	yes
AMS (out-of-phase)	yes	no
Field variations of magnetic susceptibility	yes	yes
Field variations of AMS	yes	yes
Frequency variations of magnetic susceptibility	no	yes
Frequency variations of AMS	no	yes
High-temperature variations of magnetic susceptibility	in-phase & out-of-phase	in-phase only
Low-temperature variations of magnetic susceptibility	in-phase & out-of-phase	in-phase only

Table 1: MFK2/KLY5 measurable properties

Application remarks

KLY5-A – Single frequency, in-phase and out-of phase susceptibility Kappabridge. Recommended, if the focus of research is magnetic fabric. In-phase and out-of phase AMS [1], [2] can be measured. For environmental research (assessment of ultra-fine particles on the SP/SSD boundary), one may benefit from the calibrated and stable out-of-phase susceptibility (or phase angle), which can be recalculated and directly compared to the "classical" frequency dependence parameters [3], [4]. KLY5-A also provides an improved precision for measurements of temperature variations of magnetic susceptibility (in combination with CS4 and CS-L) compared to the MFK2-FA, improved stability and linearity between measuring ranges.

MFK2-FA – Three frequency, in-phase susceptibility Kappabridge. Very good choice for standard AMS. It measures solely the in-phase AMS, but this is good enough for most magnetic fabric research. For environmental research, it can measure susceptibility at three operating frequencies so the well-established frequency dependence parameters can be determined.

References

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