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Lead-Free Piezoceramics Based on Alkali Niobates

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The market for piezoceramic components is dominated by lead-based PZT materials containing more than 60 wt% lead. Since lead is a toxic heavy metal, it has become a great concern how to eliminate the use of PZT by replacing it by non-harmful materials while maintaining comparable piezoelectric properties. This was the objective of the European LEAF project within the GROWTH programme, ending in February 2004. In this project, alkali niobates were proposed as alternative piezoceramic materials, and special emphasis was given to potassium sodium niobate, $(\text{K,Na})\text{NbO}_3$. Among the interesting properties of this system is a low theoretical density, leading to a relatively low acoustic impedance of 24 MRa. The partners of the project have developed lead-free ceramics that can be a competitive alternative to PZT for certain applications. Considerations on powder synthesis and ceramic processing, obtained properties and examples of industrial applications will be presented.