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SURFACE PATINA AND CLAY CHARACTERIZATION: MULTI-ANALYTICAL INVESTIGATIONS INTO BIDRI HANDICRAFT

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Authors:

Krishna Priya Rolla
Dr. Babasaheb Ambedkar Marathwada University

Abhijeet Shelke
Dr. Babasaheb Ambedkar Marathwada University

Bhaskar Sathe
Dr. Babasaheb Ambedkar Mara

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Abstract and Figures

Bidri handicraft in India, patronised by Bahamani kings, dates back to the fifteenth century and is nowadays under operational and socio-economic threats. The craft is made of zinc alloy, which poses scientific challenges in the areas of metallurgy, metal oxidation, and surface science. In the present paper, the art, owing to its scientific enigma, is under scrutiny, wherein the handicraft mandates the use of Bidar Fort (in Karnataka, India) clay, which bestows the handicraft its characteristic matt-black patina. The fort is a heritage conservation site and thus poses a threat to the perennial practice of handicraft. Therefore, it is imperative to document the patina and fort clay. Thus, morphological and chemical characterization of Bidri artefact surfaces was accomplished using scanning electron microscopy (SEM), X-ray Diffraction (XRD) analysis, X-ray Photoelectron Spectroscopy (XPS), and Energy Dispersive X-ray fluorescence spectroscopy (ED-XRF); besides, elemental characterization of Bidar fort clay was accomplished using SEM coupled with energy dispersive X-ray spectroscopy (EDS). This study is significant, as it is one of the initial works to scientifically document Bidri handicraft surface and clay, besides laying the foundation for future studies; a step to conserve the handicraft; and a step to prevent the deterioration of the Bidar fort monument.

Bidar Fort (prime premises) and… | Oxidation Process of Bidri… | Bidri handicraft patina-surface,… | a) Surface Morphological… | Surface Elemental…

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SURFACE PATINA AND CLAY CHARACTERIZATION: MULTI-ANALYTICAL INVESTIGATIONS INTO *BIDRI* HANDICRAFT

Krishna Priya ROLLA[1*], Abhijeet SHELKE[1,*], Bhaskar SATHE[2,*], Arbaj KHAN[1], Vijay SAPNER[2], Balaji MULIK[2]

[1] Department of Management Science, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad - 431 004 (Maharashtra) India
[2] Department of Chemistry, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad - 431 004 (Maharashtra) India

Abstract

Bidri handicraft in India, patronised by Bahamani kings, dates back to the fifteenth century and is nowadays under operational and socio-economic threats. The craft is made of zinc alloy, which poses scientific challenges in the areas of metallurgy, metal oxidation, and surface science. In the present paper, the art, owing to its scientific enigma, is under scrutiny, wherein the handicraft mandates the use of Bidar Fort (in Karnataka, India) clay, which bestows the handicraft its characteristic matt-black patina. The fort is a heritage conservation site and thus poses a threat to the perennial practice of handicraft. Therefore, it is imperative to document the patina and fort clay. Thus, morphological and chemical characterization of Bidri artefact surfaces was accomplished using scanning electron microscopy (SEM), X-ray Diffraction (XRD) analysis, X-ray Photoelectron Spectroscopy (XPS), and Energy Dispersive X-ray fluorescence spectroscopy (ED-XRF); besides, elemental characterization of Bidar fort clay was accomplished using SEM coupled with energy dispersive X-ray spectroscopy (EDS). This study is significant, as it is one of the initial works to scientifically document Bidri handicraft surface and clay, besides laying the foundation for future studies; a step to conserve the handicraft; and a step to prevent the deterioration of the Bidar fort monument.

Keywords*: Surface patina; Clay characterization; Bidri Handicraft; Bidar fort; Zinc-copper alloy; Clay oxidative properties*

Introduction

India is one of the ancient seats of practicing metal-art [1], and one such ancient metalcraft has been the *Bidri* handicraft [2]. The availability of metal mines, foundries, and dexterity with metallurgical knowledge was one of the primary reasons for metalcrafts to flourish in the country. This dexterity with metal encouraged craftsmen of the times to cater to the royalty by producing artefacts of aesthetic utility, like the *huqqas* (hubble-bubble), ornament boxes, pitchers, figurines, and other articles [3]. India is attributed to be the birthplace of zinc metal dating back to the 5th century BCE, supported by the excavations found in Lothal and Atranjikhera, in the Indian states of Gujarat and Uttar Pradesh [4, 5]. Another narrative that supports this claim is the presence of mining ores in Rajasthan, right from the Bronze age, i.e., from the mid-fourth millennium BCE [6, 7]. Further, as bronze is a copper alloy with zinc (and tin), it is obvious that zinc ores must have been prevalent before the bronze age.

* Corresponding author: rollakpriya@gmail.com, meet_abhijeet@gmail.com and bhaskarsathe@gmail.com

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