The Grande Rose of Reims cathedral: origin of the colour of stained glasses

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The Grande Rose of Reims Cathedral (France), a UNESCO Cultural Heritage Monument from the 13th century, underwent several restoration works during the 20th century. Its dramatic colours resultfrom centuries of colour management, from which little information remains. We used non-destructive and portable optical absorption spectroscopy to quantify glass colour and determine the colouring species on a large-scale study of this monumental window. On the basis of previous works on the spectroscopic properties of transition elements in glasses, we found six distinct colour groups, each containing both medieval and modern glasses, with colouring processes specific to each colour. This illustrates medieval glassmakers' mastering of glass colouring and modern glassmakers' management to reproduce medieval glasses colours, for instance by controlling the various redox equilibria involved in glass colouration. Full UV-visible-NIR energy range is necessary for determining the contribution of colouring elements as Fe2+ and Cu2+. Systematic thickness measurements reveal an average glass thickness of 3 mm and demonstrate the major control of chromophore concentration on glass colour. Yellow, red and purple colours arise from a single chromophore, suggesting the use of well- defined glassmaking techniques leading to great colour reproducibility. By contrast, blue and green glasses show different chromophore combinations depending on production time, which suggests more diversity in glassmaking.